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Atlantic
Technological
University

SG_SINDU_B07

Bachelor of Science in Industrial Laboratory Science

Programme Documentation

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Programme Overview

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|-------------------------|--|-------------------------|---------------------------------------|
| Full Title | Bachelor of Science in Industrial Laboratory Science | | |
| Status | Approved by Academic Council | Programme Code | SG_SINDU_B07 |
| Level | 07 | Required Credits | 180 |
| Delivered By | Semester | Minimum Duration | 6 |
| Start Term | 2023 | ISCED Code | 0510 - Biological and related science |
| Award Class | Ordinary Bachelor Degree Abinitio | Award Type | Bachelor of Science |
| Award Standard | Science | Department | Life Sciences |
| Delivery Mode(s) | Full Time | | |

Programme Authors

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Aim

The BSc Industrial Laboratory Science is an umbrella programme commencing at an ETB site and with three subsequent separate pathways of study completed at ATU Donegal (Letterkenny Campus; Biopharmaceutical Science), ATU Galway-Mayo (Galway City Campus; Biochemistry), or ATU Sligo (Sligo Campus; Life Sciences). The elected pathway will be given in brackets as the named BSc Industrial Laboratory Science and Higher Certificate awards. Below is a brief description of the aims and objectives of this umbrella programme relevant to all three ATU pathways.

The programme aims are to:

1. Provide learners with an opportunity to engage in higher education, enriching knowledge through online study whilst undertaking first year anchored in the ETB, and continuing learning anchored in ATU for the remainder of the programme.
2. Explore and encourage participants to further develop key skills and competencies to enhance employability and career opportunities within the life sciences sector (that includes biopharmaceutical, pharmaceutical, medical device, and laboratory-focussed industries).
3. Develop participant's skills to work and communicate with autonomy and effectively through various media.

The programme objectives are:

1. To provide a new entry route to higher education through ETB that will facilitate further graduate progression opportunities to industrial laboratory science and related disciplines.
2. To produce graduates with essential competencies and skills to function in a variety of roles in the life sciences industry that encompasses industrial pharmaceutical science, bio-industry, medical device, and laboratory-focussed sectors.
3. To ensure learners have the skills and knowledge to underpin working safely, efficiently, and effectively in industry settings.

Entry Requirements and Access Routes

This BSc Industrial Laboratory tertiary education programme aims to increase access to degree level education in a number of ways including increasing the number of locations regionally that students can begin their studies, enhancing flexibility through providing a number of programme paths, widening access through more flexible entry requirements which take account of the socio-economic and other barriers faced by the target group. Leaving Certificate requirements are lower than those which typically apply for entry to an ATU degree, and as applications are direct to the ETB this removes Leaving Certificate points as a requirement. Applicants meeting minimum requirements will be interviewed individually by the ETBs to allow for assessment of aptitude and motivation, giving consideration to the barriers faced by candidates to accessing tertiary education through other more conventional routes.

Entry Requirements:

- Leaving Certificate- Grade O6/H7 or better in five Leaving Certificate subjects. Leaving Certificate must include English or Irish and Mathematics. Maths at F2 is acceptable to meet the minimum Maths entry requirement (other than for the Engineering and Science programmes for which a minimum of O6 in Maths is required). Irish at F2 is acceptable to meet the minimum language requirements.

OR

- A Full level 5/6 QQI award (Stipulate maths codes and either LC maths or QQI maths for Science and Engineering)

OR

- Mature applicants - (aged 23 on or before 1st January of the course commencement year). These applicants do not have to meet the minimum entry requirements listed here and are considered on an individual basis (previous education, work experience, and demonstration of competence to undertake the programme)

OR

- Access programme (where LCA are allowed to gain entry to this programme)

OR

- An applicant who is a minimum of 17 years of age with at least 2 years post Junior Certificate relevant experience. All applicants must demonstrate that they would qualify for the special rate of maintenance grant under the Student Grant Scheme (SUSI) and/or are in receipt of a Department of Social Protection (DSP) long-term means-tested social welfare payment and/or be from one or more of the priority groups or from any priority group identified as part of the next National Access Plan (2022-2028). See Appendix B.
- Applicants must demonstrate competence to undertake the programme.

Selection Process

ATU, Donegal ETB, Mayo Sligo Leitrim ETB, Galway Roscommon ETB, are centres for learning committed to providing education and training to the highest standards. The programmes we offer are student centred and provided in a friendly, inclusive, and supportive environment. We aim to have students enrolled across all our programmes which reflect the diversity and social mix of Ireland's population.

The selection criteria are based on the principle of equality. ATU and the ETBs do not discriminate on any of the grounds outlined in the Equal Status Act 2000-2015.

Accordingly, we shall not discriminate in its admission of a learner based on the following grounds.

1. Gender of the Student or Applicant
2. Civil Status of the Student or Applicant
3. Family status of the Student or Applicant
4. Sexual Orientation of the Student or Applicant
5. Religion of the Student or Applicant
6. Disability of the Student or Applicant
7. Race of the Student or Applicant
8. Membership of the Traveller Community or Roma Community of the Student or Applicant
9. Socio – Economic status of the Student or Applicant
10. Age of the Student or Applicant (be aware you must be 18 to do Nursing, this is fine for the Nursing course in its current iteration but could be problematic in the future)

We will take note of the current Government policy in terms of widening participation in Further and Higher Education when selecting applicants for the new programmes. The current HEA, **National Access Plan 2022 to 2028**, identifies three main groups who are underrepresented in higher education:

- Students who 1) are socioeconomically disadvantaged; 2) are members of Irish Traveller and Roma communities and 3) have disabilities including intellectual disabilities. We recognise that students experiencing such disadvantage may come from various backgrounds including:
- Students from low-income families and/or who are long-term social welfare dependent.
- Students from socioeconomically disadvantaged areas
- Students who are mature and who previously attended higher education but did not complete a course (that is, 'second chance' mature students)
- Students who are lone parents or teen parents
- Students who are migrants or refugees or who have experience of the international protection process, or students from ethnic minorities - who do not currently hold a 3rd level qualification equal to or higher than the award offered
- Students who have experience of the care system
- Students who are survivors of domestic violence
- Students who are carers
- Students who have experienced homelessness
- Students who have experience of the criminal justice system
- Students who are members of Irish Traveller and Roma communities
- Students with disabilities including intellectual disabilities.

Selection Process

Admission to a particular course will be assessed through an application form and an interview. Each ETB will arrange interviews for all eligible applications received by the closing date. Late applicants will be put on a waiting list to be considered if places remain unfilled following the initial admissions process. A common marking scheme will be in place and used by each ETB in conjunction with ATU. Given the programmes are administered by three ETBs all interviewers will receive training in relation to the interview process and implementation of the marking scheme to ensure consistency.

Students will be ranked at each location for admission based on interview scores. In instances where it is impossible to distinguish between candidates and the programme is oversubscribed a process agreed between the ETBs and ATU will apply. Following the offering of places after the interview process if places remain to be filled late applicants can be considered using the same process.

The Project Co-ordinators will assist in the process to ensure consistency of approach. This may involve QA Teams from ATU and the three ETBs as appropriate. The process will be reviewed annually.

Selection Criteria

Subject to meeting the minimum entry requirements the following criteria will be used to assess and rank applicants:

- Prior success and achievement in formal and informal education
- Work and/or life experience
- Evidence of relevant extracurricular activities
- Motivation for/Interest and knowledge of the programme and disciplinary career options
- For Science and Engineering Mathematical Competence will be a key consideration
- Applicant is from one of the target groups outlined in the National Access Plan

Appendix A. English Language Requirements

The recommended minimum requirement for English language for entry to the Tertiary Degree Programme. This level listed represent the minimum

standard needed in general and in some fields, higher levels may be required.

Applicants for whom English is not their first language will be required to provide evidence of English Language Proficiency through one of the following mechanisms:

1. A valid certificate in English language from one of the institutions listed below.
2. English language proficiency assessment conducted by relevant ETB during the enrolment process.
3. Recognition of prior learning, which may be applied to students who have, in the previous 12 months, successfully achieved a full award in a cognate discipline at an appropriate level on the National Framework of Qualifications, e.g., at NFQ Level 5 if applying for a course at NFQ Level 6.

Minimum B2 in all skills on entry.

International Examinations: Cambridge First Certificate in English (FCE), Minimum Grade - Grade B or higher

International Examinations: Cambridge Advanced (CAE), Minimum Grade - Borderline Fail Min 170 points

International Examinations: Cambridge Proficiency (CPE), Minimum Grade- Unsuccessful With min. 170 points

International Examinations IELTS, Minimum Grade 6

Note: IELTS certificates are only valid two years from the date of assessment. It is recommended that the same validity duration is applied to all other examinations.

Appendix B

- Students from communities, groups or areas that are socio-economically disadvantaged or that have low levels of participation in higher education, including those who have experienced homelessness, the care system, survivors of domestic violence, and those who have experience of the criminal justice system.
- Socio-economically disadvantaged mature students (23 or older on 1 January of their year of entry to higher education – and having never previously accessed higher education).
- “Second-chance” socio-economically disadvantaged mature students. Such students may be considered for a bursary where they have: o previously attended but not completed a course, o had a five-year break in studies since leaving the course, and o are returning to attend an approved course.
- Students with a disability.
- Students who are carers (confirmed by the Department of Social Protection (DSP) as holding a long-term means-tested carer’s allowance).
- Members of Irish Traveller community and Roma community.
- Lone parents or teen parents (confirmed by the Department of Social Protection (DSP) as holding a long-term means-tested social welfare payment) – at least 20% of Tier 1 bursaries will be targeted at lone parents.
- Students who are migrants, refugees or who are from ethnic minorities who are lawfully present in the State.

Transfer Routes

Students successfully completing Year 1 will transfer to Year 2 in one of the three ATU elective programme pathways. Once a student has entered their chosen elective programme pathway there is no possibility of transfer to another elective programme pathway at any point during Year 2 or Year 3. However, a student may choose to exit the programme with the embedded named pathway Higher Certificate award and may use that to apply for entry onto another cognate Level 7 programme offered at ATU or elsewhere. Given this, programme transfer is not applicable to this programme.

Progression Pathways

Upon successful completion of the Level 7 BSc Industrial Laboratory Science programme (irrespective of named pathway), as well as being able to directly enter the labour market, there are a number of progression pathways onto existing ATU Level 8 programmes that are on-campus (e.g. BSc Hons Bioanalytical Science Add-On (ATU Donegal); BSc Hons in Quality for Industry (ATU Galway-Mayo); BSc Hons Medical Biotechnology Add-On (ATU Sligo)), online (e.g. BSc Hons Biopharmaceutical Science (ATU Sligo)), and for those with cognate employment a workplace-based learning programme (BSc Hons Applied Industrial Science). From there, additional existing progression pathways are available onto ATU Level 9 (on-campus, online), and ATU Level 10 (PhD).

Teaching & Learning Strategy

Throughout the BSc Industrial Laboratory Science programme a range of teaching and learning methods will be used to support delivery of composite modules from Year 1 in the ETB through Years 2 and 3 in the three ATU sites, all of which are strategically designed to meet the needs of students preparing for engagement in further learning or employment. From Year 1 students will engage in a range of campus-based and online modules which will give students the opportunity to engage in a range of teaching and learning activities, and modules will include tutorials augmented by independent and directed learning using the ATU VLE, a repository of learning material and resources and which additionally facilitates assessment. On first glance it may seem like a large number of assessments in Year 1 however, it is critical to emphasise that many assessments take place during class sessions such as written laboratory reports, group projects, MCQs, practical evaluations etc. As noted elsewhere, in most cases modules comprising the programme are delivered on other programmes of study where teaching and learning strategies have evolved with time, to include aspects of Universal Design for Learning (UDL) such as multiple means of representation, engagement, action, and expression. The programme has been carefully designed to help build student confidence and competence to enhance graduate skills and employability.

Assessment Strategy

When designing the programme, there was careful consideration of the balance between campus-based and online modules, with additional thought given to the blend of assessed activities between formative and summative assessments plus modules that did and did not include a terminal examination. Implicit in programme design was the inclusion of modules that used a range of appropriate assessment methodologies that would both extend the student's transferable skills and best address both module and programme learning outcomes. As with all programmes cognisance has been given to the nature, number, and spread of assessments across the academic year to avoid, where possible, clustering of assessment submissions. Some modules will include formative or summative testing throughout the Semester to reinforce concepts and help the student gauge their progress with module learning. Many modules also have practical classes that contribute to the summative assessment of modules which both encourage attendance and participation in a range of key learning activities in laboratory sciences. In addition to information given in the module descriptors, academic staff discuss with students the assessment schedule for each module and this information is additionally shared with students through ATU VLE and by other communication channels to best ensure students are aware of the expectations of them each Semester as they progress through the programme.

Student Feedback Strategy

A range of programme feedback strategies will be adopted throughout the three-years of study. From the start of the programme, students will be advised of the range of ways that feedback is provided to avoid any confusion or misconceptions of what constitutes feedback. Feedback will come in a range of forms, from providing information in live lectures/seminars/tutorials and laboratory classes through to group and individual feedback that may come in oral and/or written forms. Students will be encouraged to reflect on and critically evaluate their personal performance as they progress with their studies and act on all feedback they will receive from a range of sources throughout their studies anchored at ETB/ATU. Student self-assessment and reflection on personal acquisition of knowledge and skills, plus limitations, will be encouraged through a range of modules and in the preparation of portfolio-based work notably in the work practice-related modules to enhance student ability to receive and act on feedback in preparation for further study and employment.

Additional Information

Programme Learning Outcomes

| Strand | Programme Learning Outcomes <i>On successful completion of this programme the learner will/should be able to:</i> | Modules Mapped to Outcomes |
|-------------------|---|--|
| Knowledge Breadth | Demonstrate an understanding consistent with a broadly-based scientific core, to include mathematics plus theory and understanding of key aspects of industrial laboratory science. | SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry DRUG06001 Medicinal Drug Discovery and Design ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS PHRM07008 Pharmaceutical Processing and Medical Device Manufacture BIOL07013 Immunodiagnosics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement |

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| <p>Knowledge Kind</p> | <p>Integrate and use acquired knowledge of terminology, nomenclature, and/or classification systems plus subject-specific theories, concepts, and principles to demonstrate recognition of limitations and applications of understanding across a variety of areas in industrial laboratory science.</p> <p>Apply methods for acquiring, processing, interpreting, and presenting subject-specific information including identification, definition, and resolution of routine problems.</p> <p>Articulate relevant legal, quality, and regulatory frameworks plus relevant ethical and societal issues pertaining to research and development.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry DRUG06001 Medicinal Drug Discovery and Design ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS PHRM07008 Pharmaceutical Processing and Medical Device Manufacture BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| <p>Know How & Skill Range</p> | <p>Apply knowledge and understanding to address familiar problems in a scientific setting including data analysing, synthesising, and summarising skills, and evidence maintenance of detailed records of activities.</p> <p>Demonstrate ability to work independently within defined time boundaries. and source, interpret and apply appropriate and referenced literature from a specific scientific area.</p> <p>Operate a broad range of laboratory and other relevant equipment safely, evidence application of numerical, statistical, and other related skills, and communicate scientific information in a variety of forms to specialist audiences.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS PHRM07008 Pharmaceutical Processing and Medical Device Manufacture BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| <p>Know How & Skill Selectivity</p> | <p>Make decisions in relation to a controlled environment and identify and implement solutions to problems relating to scientific processes in a logical manner.</p> <p>Demonstrate ability to appreciate the views of others and key facets illustrating potential to work in the scientific industry or other relevant scientific setting.</p> <p>Test simple hypotheses and appreciate limits of knowledge in a scientific area.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 ECOL06010 Ecosystems MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| <p>Competence Context</p> | <p>Analyse and generate data, diagnose and trouble-shoot technical problems and contribute to their resolution, in a range of structured settings.</p> <p>Use scientific skills to accurately perform laboratory and other related scientific tasks.</p> <p>Behave professionally in a range of structured scientific academic and/or workplace-based settings (which may include work placement).</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| Competence Role | <p>Take direction, accept criticism and responsibility for own work, and/or exercise independent technical judgement, using feedback to enhance own performance.</p> <p>Participate in a structured team environment and/or work individually with significant autonomy on complex tasks within allocated responsibility across a range of laboratory scientific disciplines.</p> <p>Be self-directed in terms of personal time, motivation, and work planning, and be self-aware and be open and sensitive to others.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) BIOC06013 Biochemistry ECOL06010 Ecosystems INST06006 Instrumentation 2 BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| <p>Competence Learning to Learn</p> | <p>Demonstrate an ability for autonomous, independent learning, evidencing a commitment to broadening knowledge, continuing education and/or lifelong learning.</p> <p>Identify gaps in personal knowledge, understanding and skills, and identify appropriate means to gain these attributes.</p> <p>Take appropriate action to remain aware of industrial, regulatory, and societal change, which will impact on chosen specialisation.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry DRUG06001 Medicinal Drug Discovery and Design ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS PHRM07008 Pharmaceutical Processing and Medical Device Manufacture BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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| <p>Competence Insight</p> | <p>Discuss relevant industrial laboratory issues in a scientific, social, cultural, and/or economic context.</p> <p>Promote laboratory science and technology to colleagues, peers, diverse stakeholders, and/or the general public.</p> <p>Demonstrate an awareness of current issues of concern to society and an appreciation of the scientific, practical, and ethical issues involved.</p> | <p>SCI06023 Biology 1 SCI06024 Biology 2 SCI06025 Chemistry 1 SCI06026 Chemistry 2 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06028 Information Technology 2 MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE SCI06021 Introduction to Industrial Laboratory Science GMP06003 CALIBRATION SCIENCE SCI06020 Laboratory Science Skills BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) SCI06022 Laboratory Professional Practice ECOL06010 Ecosystems BIO07022 PROTEIN BIOTECHNOLOGY LAW07026 Legislation, Quality & Auditing Systems QUAL07007 Quality and Regulations GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement</p> |
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Approved Programme Schedule - SG_SINDU_B07 Bachelor of Science in Industrial Laboratory Science

Stage 1

| Delivery | Code | Module Title | Level | Credit | M/E | IL | FT | FO | CA | PRAC | PROJ | EXAM | Total |
|--------------------------------|-----------|---|-------|--------|-----|------|------|----|-----|------|------|------|-------|
| SEM 1 | SCI06023 | Biology 1 | 06 | 05 | M | 1.50 | 5.50 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 1 | SCI06025 | Chemistry 1 | 06 | 05 | M | 1.50 | 5.50 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 1 | SCI06029 | Essential Skills for Scientists | 06 | 05 | M | 5.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 1 | SCI06027 | Information Technology 1 | 06 | 05 | M | 5.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 1 | MATH06078 | Applied Mathematics | 06 | 05 | M | 5.00 | 0.00 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 1 | PHYS06005 | MEASUREMENT SCIENCE | 06 | 05 | M | 0.00 | 0.00 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 2 | SCI06024 | Biology 2 | 06 | 05 | M | 1.50 | 5.50 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 2 | SCI06026 | Chemistry 2 | 06 | 05 | M | 1.50 | 5.50 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 2 | SCI06028 | Information Technology 2 | 06 | 05 | M | 5.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 2 | SCI06021 | Introduction to Industrial Laboratory Science | 06 | 05 | M | 5.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 2 | GMP06003 | CALIBRATION SCIENCE | 06 | 05 | M | 0.00 | 0.00 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 2 | SCI06020 | Laboratory Science Skills | 06 | 05 | M | 4.00 | 1.53 | 0 | 40 | 60 | 0 | 0 | 100 |
| Total Credits Available | | | | 60 | | | | | | | | | |

| Semesters Per Stage | Elective Rules Per Stage | Credits Required Per Stage | Percentage Allocation towards Award |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| 2 | 0 | 60 | 0 |

Special Regulation

Module(s) with Failed Elements: SCI06020 Laboratory Science Skills

Stage Exit Award

Laboratory Science

Modules with Failed Elements

Module(s) containing Failed Elements: SCI06020 Laboratory Science Skills

Key

M/E - Mandatory/Elective, FT - Full Time, FO - Formative, CA - Coursework Assessment, PRAC - Practical, PROJ - Project, EXAM - Final Exam,

Approved Programme Schedule

Stage 2

| Delivery | Code | Module Title | Level | Credit | M/E | IL | FT | FO | CA | PRAC | PROJ | EXAM | Total |
|----------|-----------|-------------------------------------|-------|--------|-----|-------|------|----|-----|------|------|------|-------|
| SEM 3 | BIO06028 | Analytical Techniques | 06 | 05 | E1 | 2.00 | 5.00 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 3 | BIOC06008 | BIOCHEMISTRY 1 | 06 | 10 | E1 | 7.00 | 7.00 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 3 | MATL06007 | BIOMATERIALS AND MEDICAL DEVICES | 06 | 05 | E1 | 4.00 | 4.00 | 0 | 60 | 0 | 0 | 40 | 100 |
| SEM 3 | MCRO06001 | MICROBIOLOGY | 06 | 05 | E1 | 4.00 | 4.00 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 3 | SAFE06023 | ENVIRONMENT HEALTH AND SAFETY | 06 | 05 | E1 | 4.00 | 3.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 4 | BIO06006 | MEDICAL IMMUNOLOGY | 06 | 05 | E1 | 4.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 4 | BIOL06017 | Molecular Biology | 06 | 10 | E1 | 8.00 | 6.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 4 | MCRO06002 | PROCESS MICROBIOLOGY | 06 | 05 | E1 | 4.00 | 4.00 | 0 | 65 | 0 | 0 | 35 | 100 |
| SEM 4 | SCI06019 | Job Readiness (Science) | 06 | 05 | M | 5.00 | 0.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 4 | SCI06022 | Laboratory Professional Practice | 06 | 05 | M | 5.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 3 | CHEM06051 | Instrumentation 1 | 06 | 10 | E2 | 10.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 3 | BIOC06013 | Biochemistry | 06 | 10 | E2 | 10.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 3 | DRUG06001 | Medicinal Drug Discovery and Design | 06 | 05 | E2 | 8.00 | 3.00 | 0 | 30 | 0 | 0 | 70 | 100 |
| SEM 3 | ECOL06010 | Ecosystems | 06 | 05 | E2 | 3.00 | 5.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 4 | INST06006 | Instrumentation 2 | 06 | 10 | E2 | 6.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 4 | MCRO06016 | Fundamentals of Microbiology | 06 | 10 | E2 | 10.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| YEAR | GMIT06022 | Biochemistry | 06 | 10 | E3 | 0.00 | 5.00 | 0 | 30 | 30 | 0 | 40 | 100 |
| SEM 3 | GMIT06023 | Analytical Techniques 2.1 | 06 | 05 | E3 | 0.00 | 4.50 | 0 | 10 | 50 | 0 | 40 | 100 |
| SEM 3 | GMIT06024 | Molecular Biology 2.1 | 06 | 05 | E3 | 0.00 | 3.00 | 0 | 20 | 40 | 0 | 40 | 100 |
| SEM 3 | GMIT06026 | Microbiology 1 | 06 | 05 | E3 | 0.00 | 4.50 | 0 | 20 | 30 | 0 | 50 | 100 |
| SEM 3 | GMIT06021 | Data Modelling and Statistics | 06 | 05 | E3 | 0.00 | 4.00 | 0 | 60 | 40 | 0 | 0 | 100 |
| SEM 3 | GMIT06025 | Quality Management I | 06 | 05 | E3 | 0.00 | 2.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 4 | GMIT06027 | Analytical Techniques 2.2 | 06 | 05 | E3 | 0.00 | 4.00 | 0 | 20 | 40 | 0 | 40 | 100 |
| SEM 4 | GMIT06029 | Molecular Biology 2.2 | 06 | 05 | E3 | 0.00 | 4.00 | 0 | 60 | 0 | 0 | 40 | 100 |
| SEM 4 | GMIT06028 | Microbiology 2 | 06 | 05 | E3 | 0.00 | 4.50 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 4 | GMIT06030 | Instrumentation 2.1 | 06 | 05 | E3 | 0.00 | 4.00 | 0 | 10 | 50 | 0 | 40 | 100 |

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|--------------------------------|-----------|----------------------------------|----|-----|----|------|------|---|-----|---|---|---|-----|
| SEM 4 | GMIT07016 | Six Sigma for Quality Management | 07 | 05 | E3 | 0.00 | 3.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| Total Credits Available | | | | 170 | | | | | | | | | |

| Semesters Per Stage | Elective Rules Per Stage | Credits Required Per Stage | Percentage Allocation towards Award |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| 2 | 3 | 60 | 0 |

| Elective Rule | Electives Required | Credits Required |
|---------------|--|--|
| ELECTIVE_1 | 8 - Select 8 Module(s), 50 Credit(s) | 50 - Select 8 Module(s), 50 Credit(s) |
| ELECTIVE_2 | 6 - Select 6 Module(s), 50 Credit(s) | 50 - Select 6 Module(s), 50 Credit(s) |
| ELECTIVE_3 | 11 - Select 11 Module(s), 60 Credit(s) | 60 - Select 11 Module(s), 60 Credit(s) |

Special Regulation

There are three elective pathways through the BSc Industrial Laboratory Science programme. Stage 2 Elective 1 refers to ATU Sligo pathway. Stage 2 Elective 2 refers to ATU Donegal pathway. Stage 2 Elective 3 refers to ATU Galway-Mayo pathway.

Module(s) with Failed Elements: CHEM06051 Instrumentation 1, BIOC06013 Biochemistry, DRUG06001 Medicinal Drug Discovery and Design, ECOL06010 Ecosystems, INST06006 Instrumentation 2, MCRO06016 Fundamentals of Microbiology, GMIT06022 Biochemistry, GMIT06024 Molecular Biology 2.1, GMIT06027 Analytical Techniques 2.2, GMIT06028 Microbiology 2, GMIT06030 Instrumentation 2.1, GMIT07016 Six Sigma for Quality Management

Stage Exit Award

Industrial Laboratory Science

Grade Mode - Pass/Fail Modules

Module(s) graded on a Pass/Fail basis: GMIT06022 Biochemistry

Modules with Failed Elements

Module(s) containing Failed Elements: CHEM06051 Instrumentation 1, BIOC06013 Biochemistry, DRUG06001 Medicinal Drug Discovery and Design, ECOL06010 Ecosystems, INST06006 Instrumentation 2, MCRO06016 Fundamentals of Microbiology, GMIT06023 Analytical Techniques 2.1, GMIT06024 Molecular Biology 2.1, GMIT06026 Microbiology 1, GMIT06027 Analytical Techniques 2.2, GMIT06029 Molecular Biology 2.2, GMIT06028 Microbiology 2, GMIT06030 Instrumentation 2.1

Key

M/E - Mandatory/Elective, FT - Full Time, FO - Formative, CA - Coursework Assessment, PRAC - Practical, PROJ - Project, EXAM - Final Exam,

Approved Programme Schedule

Stage 3

| Delivery | Code | Module Title | Level | Credit | M/E | IL | FT | FO | CA | PRAC | PROJ | EXAM | Total |
|--------------------------------|-----------|--|-------|--------|-----|------|------|----|-----|------|------|------|-------|
| SEM 5 | BIO07014 | Bioanalytical Techniques L7 Theory. | 07 | 05 | E4 | 0.00 | 0.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | BIO07022 | PROTEIN BIOTECHNOLOGY | 07 | 05 | E4 | 5.00 | 2.00 | 0 | 60 | 0 | 40 | 0 | 100 |
| SEM 5 | BIO07036 | Animal Cell Culture | 07 | 10 | E4 | 8.00 | 6.00 | 0 | 0 | 50 | 0 | 50 | 100 |
| SEM 5 | MATH07036 | STATISTICS FOR SCIENTISTS | 07 | 05 | E4 | 4.00 | 3.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | PHRM07008 | Pharmaceutical Processing and Medical Device Manufacture | 07 | 05 | E4 | 4.00 | 3.00 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 6 | BIOL07013 | Immunodiagnostics | 07 | 05 | E4 | 3.00 | 4.00 | 0 | 0 | 50 | 0 | 50 | 100 |
| SEM 6 | LAW07026 | Legislation, Quality & Auditing Systems | 07 | 05 | E4 | 4.00 | 4.00 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 6 | MCRO07004 | Microbial Biotechnology | 07 | 05 | E4 | 3.00 | 4.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 6 | PHRM07018 | PHARMACEUTICAL ANALYSIS | 07 | 10 | E4 | 8.00 | 6.00 | 0 | 55 | 10 | 0 | 35 | 100 |
| SEM 6 | BIO07026 | BIOCONTAMINATION CONTROL | 07 | 05 | M | 3.00 | 0.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | MCRO07005 | Applied Microbiology and Cleanroom Technology | 07 | 10 | E5 | 0.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | BIOL07015 | Mammalian Cell Culture | 07 | 05 | E5 | 0.00 | 5.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 5 | PHRM07025 | Pharmaceutical Chemistry | 07 | 10 | E5 | 0.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | PHRM07026 | Pharmaceutical Processes and Medical Devices | 07 | 05 | E5 | 0.00 | 5.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| SEM 6 | QUAL07007 | Quality and Regulations | 07 | 05 | E5 | 0.00 | 3.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 6 | PHRM07027 | Medicinal Drug Analysis | 07 | 10 | E5 | 0.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 6 | ENVR07059 | Environmental Analysis | 07 | 10 | E5 | 0.00 | 7.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | GMIT07022 | Applied Enzymology & Immunology | 07 | 05 | E6 | 0.00 | 4.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | GMIT07017 | Spectrophotometric Methods of Analysis 3.1 | 07 | 05 | E6 | 0.00 | 4.50 | 0 | 10 | 50 | 0 | 40 | 100 |
| SEM 5 | GMIT07020 | Advanced Molecular and Biochemical Techniques | 07 | 05 | E6 | 3.00 | 4.00 | 0 | 60 | 0 | 0 | 40 | 100 |
| SEM 5 | GMIT07018 | Microbiological Quality Control | 07 | 05 | E6 | 0.00 | 4.50 | 0 | 40 | 0 | 0 | 60 | 100 |
| SEM 5 | GMIT07021 | Validation | 07 | 05 | E6 | 0.00 | 3.00 | 0 | 50 | 0 | 0 | 50 | 100 |
| SEM 5 | GMIT07019 | Quality Management II | 07 | 05 | E6 | 0.00 | 2.00 | 0 | 30 | 0 | 0 | 70 | 100 |
| SEM 6 | GMIT07023 | Placement | 07 | 30 | E6 | 0.00 | 3.00 | 0 | 100 | 0 | 0 | 0 | 100 |
| Total Credits Available | | | | 175 | | | | | | | | | |

| Semesters Per Stage | Elective Rules Per Stage | Credits Required Per Stage | Percentage Allocation towards Award |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| 2 | 3 | 180 | 100 |

| Elective Rule | Electives Required | Credits Required |
|---------------|--------------------------------------|---------------------------------------|
| ELECTIVE_4 | 9 - Select 9 Module(s), 55 Credit(s) | 55 - Select 9 Module(s), 55 Credit(s) |
| ELECTIVE_5 | 7 - Select 7 Module(s), 55 Credit(s) | 55 - Select 7 Module(s), 55 Credit(s) |
| ELECTIVE_6 | 7 - Select 7 Module(s), 60 Credit(s) | 60 - Select 7 Module(s), 60 Credit(s) |

Special Regulation

There are three elective pathways through the BSc Industrial Laboratory Science programme. Stage 3 Elective 4 refers to ATU Sligo pathway. Stage 3 Elective 5 refers to ATU Donegal pathway. Stage 3 Elective 6 refers to ATU Galway-Mayo pathway.

Module(s) with Failed Elements: PHRM07018 PHARMACEUTICAL ANALYSIS, MCRO07005 Applied Microbiology and Cleanroom Technology , BIOL07015 Mammalian Cell Culture , PHRM07025 Pharmaceutical Chemistry, PHRM07026 Pharmaceutical Processes and Medical Devices, QUAL07007 Quality and Regulations, PHRM07027 Medicinal Drug Analysis, ENVR07059 Environmental Analysis, GMIT07022 Applied Enzymology & Immunology, GMIT07017 Spectrophotometric Methods of Analysis 3.1, GMIT07020 Advanced Molecular and Biochemical Techniques, GMIT07018 Microbiological Quality Control, GMIT07021 Validation

Grade Mode - Pass/Fail Modules

Module(s) graded on a Pass/Fail basis: GMIT07023 Placement

Modules with Failed Elements

Module(s) containing Failed Elements: MCRO07005 Applied Microbiology and Cleanroom Technology , BIOL07015 Mammalian Cell Culture , PHRM07025 Pharmaceutical Chemistry, PHRM07026 Pharmaceutical Processes and Medical Devices, QUAL07007 Quality and Regulations, PHRM07027 Medicinal Drug Analysis, ENVR07059 Environmental Analysis, GMIT07022 Applied Enzymology & Immunology, GMIT07020 Advanced Molecular and Biochemical Techniques, GMIT07018 Microbiological Quality Control, GMIT07021 Validation

Key

M/E - Mandatory/Elective, FT - Full Time, FO - Formative, CA - Coursework Assessment, PRAC - Practical, PROJ - Project, EXAM - Final Exam,

Programme Delivery Schedule

Stage 1 - Delivery Mode Full Time

| Delivery | Code | Module Title | Level | Credit | M/E | Lecture | Practical / Laboratory | Total |
|--------------|-----------|---|-------|--------|-----|---------|---------------------------|-------|
| SEM 1 | SCI06023 | Biology 1 | 06 | 05 | M | 3 | 2.5 | 5.50 |
| SEM 1 | SCI06025 | Chemistry 1 | 06 | 05 | M | 3 | 2.5 | 5.50 |
| SEM 1 | SCI06029 | Essential Skills for Scientists | 06 | 05 | M | | 2 | 2.00 |
| SEM 1 | SCI06027 | Information Technology 1 | 06 | 05 | M | | 2 | 2.00 |
| SEM 1 | MATH06078 | Applied Mathematics | 06 | 05 | M | | | |
| SEM 1 | PHYS06005 | MEASUREMENT SCIENCE | 06 | 05 | M | | | |
| SEM 2 | SCI06024 | Biology 2 | 06 | 05 | M | 3 | 2.5 | 5.50 |
| SEM 2 | SCI06026 | Chemistry 2 | 06 | 05 | M | 3 | 2.5 | 5.50 |
| SEM 2 | SCI06028 | Information Technology 2 | 06 | 05 | M | | 2 | 2.00 |
| SEM 2 | SCI06021 | Introduction to Industrial Laboratory Science | 06 | 05 | M | 2 | | 2.00 |
| SEM 2 | GMP06003 | CALIBRATION SCIENCE | 06 | 05 | M | | | |
| SEM 2 | SCI06020 | Laboratory Science Skills | 06 | 05 | M | 1 | 0.53 | 1.53 |
| Total | | | | | | 15.00 | 16.53 | |

| Stage Average Weekly Contact Hours | Semester 1 Average Weekly Contact Hours | Semester 2 Average Weekly Contact Hours |
|------------------------------------|---|---|
| 0 | 0 | 0 |

Programme Delivery Schedule

Stage 2 - Delivery Mode Full Time

| Delivery | Code | Module Title | Level | Credit | M/E | Lecture | Tutorial | Practical / Laboratory | Total |
|----------|-----------|-------------------------------------|-------|--------|-----|---------|----------|------------------------|-------|
| SEM 3 | BIO06028 | Analytical Techniques | 06 | 05 | E1 | 2 | | 3 | 5.00 |
| SEM 3 | BIOC06008 | BIOCHEMISTRY 1 | 06 | 10 | E1 | 3 | 1 | 3 | 7.00 |
| SEM 3 | MATL06007 | BIOMATERIALS AND MEDICAL DEVICES | 06 | 05 | E1 | 2 | | 2 | 4.00 |
| SEM 3 | MCRO06001 | MICROBIOLOGY | 06 | 05 | E1 | 2 | | 2 | 4.00 |
| SEM 3 | SAFE06023 | ENVIRONMENT HEALTH AND SAFETY | 06 | 05 | E1 | 3 | | | 3.00 |
| SEM 4 | BIO06006 | MEDICAL IMMUNOLOGY | 06 | 05 | E1 | 2 | | | 2.00 |
| SEM 4 | BIOL06017 | Molecular Biology | 06 | 10 | E1 | 3 | | 3 | 6.00 |
| SEM 4 | MCRO06002 | PROCESS MICROBIOLOGY | 06 | 05 | E1 | 2 | | 2 | 4.00 |
| SEM 4 | SCI06019 | Job Readiness (Science) | 06 | 05 | M | | | | |
| SEM 4 | SCI06022 | Laboratory Professional Practice | 06 | 05 | M | 2 | | | 2.00 |
| SEM 3 | CHEM06051 | Instrumentation 1 | 06 | 10 | E2 | 3 | 1 | 3 | 7.00 |
| SEM 3 | BIOC06013 | Biochemistry | 06 | 10 | E2 | 3 | 1 | 3 | 7.00 |
| SEM 3 | DRUG06001 | Medicinal Drug Discovery and Design | 06 | 05 | E2 | 3 | | | 3.00 |
| SEM 3 | ECOL06010 | Ecosystems | 06 | 05 | E2 | 2 | | 3 | 5.00 |
| SEM 4 | INST06006 | Instrumentation 2 | 06 | 10 | E2 | 3 | 1 | 3 | 7.00 |
| SEM 4 | MCRO06016 | Fundamentals of Microbiology | 06 | 10 | E2 | 3 | | 4 | 7.00 |
| YEAR | GMIT06022 | Biochemistry | 06 | 10 | E3 | 3 | | 2 | 5.00 |
| SEM 3 | GMIT06023 | Analytical Techniques 2.1 | 06 | 05 | E3 | 2 | | 2.5 | 4.50 |
| SEM 3 | GMIT06024 | Molecular Biology 2.1 | 06 | 05 | E3 | 1 | | 2 | 3.00 |
| SEM 3 | GMIT06026 | Microbiology 1 | 06 | 05 | E3 | 3 | | 1.5 | 4.50 |
| SEM 3 | GMIT06021 | Data Modelling and Statistics | 06 | 05 | E3 | 2 | | 2 | 4.00 |
| SEM 3 | GMIT06025 | Quality Management I | 06 | 05 | E3 | 2 | | | 2.00 |
| SEM 4 | GMIT06027 | Analytical Techniques 2.2 | 06 | 05 | E3 | 2 | | 2 | 4.00 |
| SEM 4 | GMIT06029 | Molecular Biology 2.2 | 06 | 05 | E3 | 1 | | 3 | 4.00 |
| SEM 4 | GMIT06028 | Microbiology 2 | 06 | 05 | E3 | 3 | | 1.5 | 4.50 |

| | | | | | | | | | |
|--------------|-----------|----------------------------------|----|----|----|-------|------|-------|------|
| SEM 4 | GMIT06030 | Instrumentation 2.1 | 06 | 05 | E3 | 2 | | 2 | 4.00 |
| SEM 4 | GMIT07016 | Six Sigma for Quality Management | 07 | 05 | E3 | 3 | | | 3.00 |
| Total | | | | | | 62.00 | 4.00 | 49.50 | |

| Stage Average Weekly Contact Hours | Semester 1 Average Weekly Contact Hours | Semester 2 Average Weekly Contact Hours |
|------------------------------------|---|---|
| 0 | 0 | 0 |

Programme Delivery Schedule

Stage 3 - Delivery Mode Full Time

| Delivery | Code | Module Title | Level | Credit | M/E | Lecture | Practical / Laboratory | Off-Site Activity | Supervision | Total |
|--------------|-----------|--|-------|--------|-----|---------|------------------------|-------------------|-------------|-------|
| SEM 5 | BIO07014 | Bioanalytical Techniques L7 Theory. | 07 | 05 | E4 | | | | | |
| SEM 5 | BIO07022 | PROTEIN BIOTECHNOLOGY | 07 | 05 | E4 | 2 | | | | 2.00 |
| SEM 5 | BIO07036 | Animal Cell Culture | 07 | 10 | E4 | 3 | 3 | | | 6.00 |
| SEM 5 | MATH07036 | STATISTICS FOR SCIENTISTS | 07 | 05 | E4 | 2 | 1 | | | 3.00 |
| SEM 5 | PHRM07008 | Pharmaceutical Processing and Medical Device Manufacture | 07 | 05 | E4 | 3 | | | | 3.00 |
| SEM 6 | BIOL07013 | Immunodiagnostics | 07 | 05 | E4 | 2 | | | 2 | 4.00 |
| SEM 6 | LAW07026 | Legislation, Quality & Auditing Systems | 07 | 05 | E4 | 3 | | | | 4.00 |
| SEM 6 | MCRO07004 | Microbial Biotechnology | 07 | 05 | E4 | 2 | 2 | | | 4.00 |
| SEM 6 | PHRM07018 | PHARMACEUTICAL ANALYSIS | 07 | 10 | E4 | 2 | 3 | | | 6.00 |
| SEM 6 | BIO07026 | BIOCONTAMINATION CONTROL | 07 | 05 | M | | | | | |
| SEM 5 | MCRO07005 | Applied Microbiology and Cleanroom Technology | 07 | 10 | E5 | 4 | 3 | | | 7.00 |
| SEM 5 | BIOL07015 | Mammalian Cell Culture | 07 | 05 | E5 | 2 | 3 | | | 5.00 |
| SEM 5 | PHRM07025 | Pharmaceutical Chemistry | 07 | 10 | E5 | 3 | 4 | | | 7.00 |
| SEM 5 | PHRM07026 | Pharmaceutical Processes and Medical Devices | 07 | 05 | E5 | 3 | | 2 | | 5.00 |
| SEM 6 | QUAL07007 | Quality and Regulations | 07 | 05 | E5 | 3 | | | | 3.00 |
| SEM 6 | PHRM07027 | Medicinal Drug Analysis | 07 | 10 | E5 | 3 | 4 | | | 7.00 |
| SEM 6 | ENVR07059 | Environmental Analysis | 07 | 10 | E5 | 4 | 3 | | | 7.00 |
| SEM 5 | GMIT07022 | Applied Enzymology & Immunology | 07 | 05 | E6 | 2 | 2 | | | 4.00 |
| SEM 5 | GMIT07017 | Spectrophotometric Methods of Analysis 3.1 | 07 | 05 | E6 | 2 | 2.5 | | | 4.50 |
| SEM 5 | GMIT07020 | Advanced Molecular and Biochemical Techniques | 07 | 05 | E6 | 2 | 2 | | | 4.00 |
| SEM 5 | GMIT07018 | Microbiological Quality Control | 07 | 05 | E6 | 2.5 | 2 | | | 4.50 |
| SEM 5 | GMIT07021 | Validation | 07 | 05 | E6 | 3 | | | | 3.00 |
| SEM 5 | GMIT07019 | Quality Management II | 07 | 05 | E6 | 2 | | | | 2.00 |
| SEM 6 | GMIT07023 | Placement | 07 | 30 | E6 | | | | 3 | 3.00 |
| Total | | | | | | 54.50 | 34.50 | 2.00 | 5.00 | |

| Stage Average Weekly Contact Hours | Semester 1 Average Weekly Contact Hours | Semester 2 Average Weekly Contact Hours |
|------------------------------------|---|---|
| 0 | 0 | 0 |

Programme Assessment Matrix

Stage 1 Semester 1

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-----------|---------------------------------|-----|------|--|--------------------------|------------|-----------------|
| MATH06078 | Applied Mathematics | M | CA | CA test 1 | 1,2,3 | 15 | Week 7 |
| MATH06078 | Applied Mathematics | M | CA | CA test 2 | 4,5 | 15 | Week 12 |
| MATH06078 | Applied Mathematics | M | EXAM | Final Exam | 1,2,3,4,5 | 60 | End of Term |
| PHYS06005 | Measurement Science | M | EXAM | Final Exam | 1,2,3,4 | 60 | End of Term |
| SCI06023 | Biology 1 | M | EXAM | Final Exam | 1,2,3 | 35 | End of Semester |
| SCI06025 | Chemistry 1 | M | EXAM | Final Exam | 1,2,3,4 | 35 | End of Semester |
| SCI06023 | Biology 1 | M | CA | Practical skills evaluation, written laboratory reports | 4 | 50 | OnGoing |
| SCI06023 | Biology 1 | M | CA | Multiple Choice Questions | 1,2,3 | 15 | OnGoing |
| SCI06023 | Biology 1 | M | CA | Multiple Choice Questions | 1,2,3 | 0 | OnGoing |
| SCI06025 | Chemistry 1 | M | CA | Self-Assessment Quizzes | 1,2,3,4,5,6 | 0 | OnGoing |
| SCI06025 | Chemistry 1 | M | CA | Multiple Choice Questions | 1,2,3,4,6 | 15 | OnGoing |
| SCI06025 | Chemistry 1 | M | CA | Laboratory Practical | 2,3,4,5,6 | 50 | OnGoing |
| SCI06029 | Essential Skills For Scientists | M | CA | Formative Assessments | 1,2,3,4,5 | 0 | OnGoing |
| SCI06029 | Essential Skills For Scientists | M | CA | Scientific Report | 3,5 | 25 | OnGoing |
| SCI06029 | Essential Skills For Scientists | M | CA | Group Project | 2,3,4 | 25 | OnGoing |
| SCI06029 | Essential Skills For Scientists | M | CA | Presentation | 1,2,3,4 | 25 | OnGoing |
| SCI06029 | Essential Skills For Scientists | M | CA | Personal Development Plan | 1,4,5 | 25 | OnGoing |
| SCI06027 | Information Technology 1 | M | CA | Practical Evaluation Weekly Class Activities | 1,2,3,4,5 | 10 | OnGoing |
| SCI06027 | Information Technology 1 | M | CA | Multiple Choice Questions (MCQs) | 2,3,4,5 | 15 | OnGoing |
| SCI06027 | Information Technology 1 | M | CA | Assignment Creation of a Report in MS Word | 3 | 25 | OnGoing |
| SCI06027 | Information Technology 1 | M | CA | Assignment Creation of a Presentation in MS PowerPoint | 4 | 20 | OnGoing |
| SCI06027 | Information Technology 1 | M | CA | End of Module Practical Evaluation covering Presentations and Spreadsheets | 4,5 | 30 | OnGoing |
| MATH06078 | Applied Mathematics | M | CA | Online Quizzes | 1,2,3,4,5 | 10 | OnGoing |
| PHYS06005 | Measurement Science | M | FO | Mathematical problems | 1,2,3,4 | UNKNOWN | OnGoing |
| PHYS06005 | Measurement Science | M | CA | Short questions | 1,2,3,4 | 40 | OnGoing |

Programme Assessment Matrix

Stage 1 Semester 2

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|----------|---|-----|------|---|--------------------------|------------|-----------------|
| SCI06020 | Laboratory Science Skills | M | CA | Written Assignment | 2,3,4 | 20 | Week 19 |
| GMP06003 | Calibration Science | M | CA | Continuous Assessment | 1,2,3,4 | 20 | Week 35 |
| GMP06003 | Calibration Science | M | CA | Continuous Assessment | 1,2,3,4 | 20 | Week 40 |
| GMP06003 | Calibration Science | M | EXAM | Final Exam | 1,2,3 | 60 | End of Term |
| SCI06024 | Biology 2 | M | EXAM | Final Exam | 1,2,3 | 35 | End of Semester |
| SCI06026 | Chemistry 2 | M | EXAM | Final Exam | 1,2,3,4 | 35 | End of Semester |
| SCI06020 | Laboratory Science Skills | M | CA | MCQ and Short Answer Questions | 3 | 20 | End of Semester |
| SCI06020 | Laboratory Science Skills | M | PRAC | Practical Evaluation | 1,2,3,4 | 60 | End of Semester |
| SCI06024 | Biology 2 | M | CA | Practical skills evaluation, written laboratory reports | 4 | 50 | OnGoing |
| SCI06024 | Biology 2 | M | CA | Multiple Choice Questions | 1,2,3 | 15 | OnGoing |
| SCI06024 | Biology 2 | M | CA | Multiple Choice Questions | 1,2,3 | 0 | OnGoing |
| SCI06026 | Chemistry 2 | M | CA | Self-Assessment Quizzes | 1,2,3,4,5,6 | 0 | OnGoing |
| SCI06026 | Chemistry 2 | M | CA | Multiple Choice Questions | 1,2,3,4,6 | 15 | OnGoing |
| SCI06026 | Chemistry 2 | M | CA | Laboratory Practical | 1,2,3,4,5,6 | 50 | OnGoing |
| SCI06028 | Information Technology 2 | M | CA | Practical Evaluation Weekly Class Activities | 1,2,3,4 | 10 | OnGoing |
| SCI06028 | Information Technology 2 | M | CA | Data Management Assessment | 4 | 20 | OnGoing |
| SCI06028 | Information Technology 2 | M | CA | Desktop Publishing Assignment | 2 | 20 | OnGoing |
| SCI06028 | Information Technology 2 | M | CA | Advanced Excel Assessment | 1 | 30 | OnGoing |
| SCI06028 | Information Technology 2 | M | CA | Online Collaborative Tools and Digital Notebook | 3,4 | 20 | OnGoing |
| SCI06021 | Introduction To Industrial Laboratory Science | M | CA | MCQ and Short Answer Questions | 1,2,3,4 | 60 | OnGoing |
| SCI06021 | Introduction To Industrial Laboratory Science | M | CA | Written Assessment | 4 | 20 | OnGoing |
| SCI06021 | Introduction To Industrial Laboratory Science | M | CA | Written Assessment | 1,2,3,4 | 20 | OnGoing |

Programme Assessment Matrix

Stage 2 Year Long

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-------------|---------------------|------------|-------------|------------------------|---------------------------------|-------------------|------------------------|
| GMIT06022 | Biochemistry | E | CA | Moodle Quiz | 1,5 | 10 | Week 5 |
| GMIT06022 | Biochemistry | E | CA | CA2 | 2 | 10 | Week 12 |
| GMIT06022 | Biochemistry | E | CA | CA3 | 3 | 10 | Week 25 |
| GMIT06022 | Biochemistry | E | EXAM | Written Paper | 4,6 | 40 | End of Year |
| GMIT06022 | Biochemistry | E | PRAC | Laboratory Performance | 6 | 30 | OnGoing |

Programme Assessment Matrix

Stage 2 Semester 1

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-----------|-------------------------------------|-----|------|--|--------------------------|------------|-----------------|
| MATL06007 | Biomaterials And Medical Devices | E | CA | Written Report Short essay on materials topic | 1,2,5 | 5 | Week 4 |
| BIOC06008 | Biochemistry 1 | E | CA | Multiple choice questions | 1,2,3,4,5,6 | 15 | Week 5 |
| BIO06028 | Analytical Techniques | E | CA | Continuous Assessment | 4 | 7 | Week 6 |
| CHEM06051 | Instrumentation 1 | E | CA | Class Test - MCQ | 1,2,5 | 5 | Week 6 |
| BIOC06013 | Biochemistry | E | CA | Class Test | 1,2,3 | 10 | Week 6 |
| DRUG06001 | Medicinal Drug Discovery And Design | E | CA | Class Test | 1,2,3,4 | 10 | Week 6 |
| ECOL06010 | Ecosystems | E | CA | Class Test | 1,2,3 | 10 | Week 6 |
| GMIT06023 | Analytical Techniques 2.1 | E | CA | A variety of online assessments Spectroscopy | 1,4,5,6 | 5 | Week 6 |
| GMIT06021 | Data Modelling And Statistics | E | CA | CA#1 | 1,2 | 30 | Week 6 |
| GMIT06025 | Quality Management I | E | CA | Midterm Moodle knowledge quiz | 1,2,3 | 25 | Week 6 |
| MCRO06001 | Microbiology | E | CA | Mid term assessment. | 1,2,3 | 15 | Week 7 |
| GMIT06025 | Quality Management I | E | CA | Group assignment and presentation based on NC, CAPA system, and SOP drafting | 3,4,6 | 40 | Week 8 |
| DRUG06001 | Medicinal Drug Discovery And Design | E | CA | Essay | 1,2,3,4 | 10 | Week 9 |
| MATL06007 | Biomaterials And Medical Devices | E | CA | Presentation Group presentation on Medical Device | 1,5 | 20 | Week 11 |
| MATL06007 | Biomaterials And Medical Devices | E | CA | Short quiz | 1,2,3 | 5 | Week 12 |
| CHEM06051 | Instrumentation 1 | E | CA | Project | | 5 | Week 12 |
| DRUG06001 | Medicinal Drug Discovery And Design | E | CA | Presentation | 1,2,3,4 | 10 | Week 12 |
| GMIT06023 | Analytical Techniques 2.1 | E | CA | A variety of online assessments Chromatography | 1,4,5,6 | 5 | Week 12 |
| GMIT06021 | Data Modelling And Statistics | E | CA | CA#2 | 3,4 | 30 | Week 12 |
| BIO06028 | Analytical Techniques | E | CA | Continuous Assessment | 1,2 | 8 | Week 13 |
| GMIT06021 | Data Modelling And Statistics | E | PRAC | Excel Exam | | 30 | Week 13 |
| CHEM06051 | Instrumentation 1 | E | EXAM | Final Exam | 1,2,3,4,5,6 | 50 | Week 15 |
| BIOC06013 | Biochemistry | E | EXAM | Final Exam | 1,2,3,4,5,6 | 50 | Week 15 |

| | | | | | | | |
|-----------|-------------------------------------|---|------|--|-------------|---------|-----------------|
| DRUG06001 | Medicinal Drug Discovery And Design | E | EXAM | Final Exam | 1,2,3,4 | 70 | Week 15 |
| ECOL06010 | Ecosystems | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | Week 15 |
| BIO06028 | Analytical Techniques | E | EXAM | End of Semester Exam | 1,2,3,4 | 35 | End of Term |
| MATL06007 | Biomaterials And Medical Devices | E | EXAM | Final Exam | 1,2,3 | 40 | End of Term |
| MCRO06001 | Microbiology | E | EXAM | Final theory examination | 1,2,3,4,5,6 | 35 | End of Term |
| BIOC06008 | Biochemistry 1 | E | EXAM | Final Exam | 1,2,3,4,5,6 | 35 | End of Semester |
| GMIT06023 | Analytical Techniques 2.1 | E | EXAM | Final Exam End of Semester - on computer | 1,2,3,4,5,6 | 40 | End of Semester |
| GMIT06024 | Molecular Biology 2.1 | E | EXAM | Final Exam | 1,2,3,4,5,6 | 40 | End of Semester |
| GMIT06026 | Microbiology 1 | E | EXAM | End-of-Semester Examination | 1,2,4,6,7 | 50 | End of Semester |
| GMIT06025 | Quality Management I | E | CA | End of term Moodle knowledge quiz | 1,2,3,4,5,6 | 25 | End of Semester |
| BIO06028 | Analytical Techniques | E | CA | Laboratory Reports, Quality of Analytical results, Laboratory Technique, Pre-laboratory exercises, Practical Exam. | 2,3,4,5 | 50 | OnGoing |
| BIOC06008 | Biochemistry 1 | E | FO | Multiple choice questions in lecture | 1,2,3,4,5,6 | UNKNOWN | OnGoing |
| BIOC06008 | Biochemistry 1 | E | CA | Practical skills evaluation | 7 | 50 | OnGoing |
| MATL06007 | Biomaterials And Medical Devices | E | CA | Practical Evaluation Laboratory report | 4 | 30 | OnGoing |
| MCRO06001 | Microbiology | E | CA | Health and safety compliance - safe handling of microbes, safety glasses compliance | 5 | 5 | OnGoing |
| MCRO06001 | Microbiology | E | CA | Post practical assessments | 4,10 | 15 | OnGoing |
| MCRO06001 | Microbiology | E | CA | Practical skills assessment. | 8 | 10 | OnGoing |
| MCRO06001 | Microbiology | E | CA | Group laboratory based mini project on identification of an unknown microbe | 7,9,11 | 15 | OnGoing |
| MCRO06001 | Microbiology | E | CA | Report preparation and submission | 4 | 5 | OnGoing |
| SAFE06023 | Environment Health And Safety | E | FO | Class discussion and feedback. | 1,3,4,5 | UNKNOWN | OnGoing |
| SAFE06023 | Environment Health And Safety | E | CA | Individual Project Hazard Identification and Risk Assessment project based on a prescribed work environment | 1,4,5 | 20 | OnGoing |
| SAFE06023 | Environment Health And Safety | E | CA | Group project integrating the principles of EHS into a chemical/pharmaceutical/ prescribed workplace setting | 1,2,3,4,5 | 40 | OnGoing |
| SAFE06023 | Environment Health And Safety | E | CA | Short Answer Questions exam of questions covering the entire module content | 1,2,3,4,5 | 40 | OnGoing |
| CHEM06051 | Instrumentation 1 | E | CA | Laboratory Practicals | | 40 | OnGoing |
| BIOC06013 | Biochemistry | E | CA | Laboratory Practicals | 6 | 40 | OnGoing |

| | | | | | | | |
|-----------|-------------------------------|---|------|---|-------------|----|---------|
| ECOL06010 | Ecosystems | E | CA | Practicals | 4,5 | 40 | OnGoing |
| GMIT06023 | Analytical Techniques 2.1 | E | PRAC | Practical Evaluation, Laboratory Report Spectroscopy | 1,2,3,4,5,6 | 25 | OnGoing |
| GMIT06023 | Analytical Techniques 2.1 | E | PRAC | Practical Evaluation, Laboratory report Chromatography | 1,2,3,4,5,6 | 25 | OnGoing |
| GMIT06024 | Molecular Biology 2.1 | E | PRAC | Practical CA | 2,3,4,5,6 | 40 | OnGoing |
| GMIT06024 | Molecular Biology 2.1 | E | CA | Theory CA | 1,2,5 | 20 | OnGoing |
| GMIT06026 | Microbiology 1 | E | CA | Online quizzes (various formats) | 2,3,4,5 | 20 | OnGoing |
| GMIT06026 | Microbiology 1 | E | PRAC | Online Assessments and Practical Laboratory Assessment | 1,2,3,4,5 | 30 | OnGoing |
| GMIT06021 | Data Modelling And Statistics | E | PRAC | Weekly Excel Labs | 1,2,3,4 | 10 | OnGoing |
| GMIT06025 | Quality Management I | E | CA | Participation - Engagement in class and with the module VLE | | 10 | OnGoing |

Programme Assessment Matrix

Stage 2 Semester 2

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-----------|----------------------------------|-----|------|---|--------------------------|------------|-----------------|
| INST06006 | Instrumentation 2 | E | CA | Class Test: MCQ | 1,2,5 | 5 | Week 21 |
| MCRO06016 | Fundamentals Of Microbiology | E | CA | Class Test | 1,2,4 | 5 | Week 21 |
| MCRO06002 | Process Microbiology | E | CA | Mid term assessment | 1 | 15 | Week 22 |
| SCI06022 | Laboratory Professional Practice | M | CA | Written Assessment (Reflective Report on Professional Practice in Industry incl. Site Visits) | 1,5 | 30 | Week 27 |
| INST06006 | Instrumentation 2 | E | CA | Independent Project | 1,2,5,6 | 5 | Week 27 |
| MCRO06016 | Fundamentals Of Microbiology | E | CA | Class Test | 3,4,5 | 5 | Week 27 |
| BIOL06017 | Molecular Biology | E | CA | Practical assessments | 6,7,8 | 15 | Week 28 |
| INST06006 | Instrumentation 2 | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | Week 30 |
| MCRO06016 | Fundamentals Of Microbiology | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | Week 30 |
| BIOL06017 | Molecular Biology | E | EXAM | Final Exam | 1,2,3,4,5,6 | 50 | End of Term |
| MCRO06002 | Process Microbiology | E | EXAM | Final theory examination | 1,2 | 35 | End of Term |
| GMIT06027 | Analytical Techniques 2.2 | E | EXAM | End of Term Final Exam | 1,4,5,6,7,8 | 40 | End of Semester |
| GMIT06029 | Molecular Biology 2.2 | E | EXAM | Final Exam | 1,2,3,4,5,6 | 40 | End of Semester |
| GMIT06028 | Microbiology 2 | E | EXAM | Formal End of Semester Examinations | 2,4,5,7 | 50 | End of Semester |
| GMIT06030 | Instrumentation 2.1 | E | EXAM | Final Exam Written examination | 1,2,3 | 40 | End of Semester |
| GMIT07016 | Six Sigma For Quality Management | E | CA | Assessment | 1,2,3,4,5 | 100 | End of Semester |
| BIO06006 | Medical Immunology | E | CA | Continuous assessment of course work | 1,2 | 30 | OnGoing |
| BIO06006 | Medical Immunology | E | CA | Continuous assessment of course work | 3,4 | 30 | OnGoing |
| BIO06006 | Medical Immunology | E | CA | Continuous assessment of course work | 5,6 | 40 | OnGoing |
| BIOL06017 | Molecular Biology | E | FO | Self Assessment Quiz | 1,2,3,4,5 | 0 | OnGoing |
| BIOL06017 | Molecular Biology | E | CA | Practical reports | 6,7,8 | 22 | OnGoing |
| BIOL06017 | Molecular Biology | E | CA | Data analysis | 6,8 | 13 | OnGoing |
| MCRO06002 | Process Microbiology | E | CA | Health and safety compliance - safe handling of microbes, safety glasses compliance | 4 | 5 | OnGoing |
| MCRO06002 | Process Microbiology | E | CA | Post practical assessments | 3,5,7 | 30 | OnGoing |
| MCRO06002 | Process Microbiology | E | CA | Practical skills assessment | 6 | 10 | OnGoing |

| | | | | | | | |
|-----------|----------------------------------|---|------|--|-----------------|----|---------|
| MCRO06002 | Process Microbiology | E | CA | Report preparation and submission | 5 | 5 | OnGoing |
| SCI06019 | Job Readiness (Science) | M | CA | Quizzes (through VLE) | 1,3,4 | 50 | OnGoing |
| SCI06019 | Job Readiness (Science) | M | CA | Structured reflective journal/portfolio and recorded "elevator pitch" style presentation | 1,2,4 | 50 | OnGoing |
| SCI06022 | Laboratory Professional Practice | M | CA | MCQ and Short Answer Questions | 1,2,3,4,5 | 70 | OnGoing |
| INST06006 | Instrumentation 2 | E | CA | Laboratory Practicals and Reports | 5,6 | 40 | OnGoing |
| MCRO06016 | Fundamentals Of Microbiology | E | CA | Laboratory Practicals | 1,2,3,4,5,6 | 40 | OnGoing |
| GMIT06027 | Analytical Techniques 2.2 | E | PRAC | Practical Evaluation | 1,2,3,4,5,6,7,8 | 40 | OnGoing |
| GMIT06027 | Analytical Techniques 2.2 | E | CA | Online Assessments | 1,6,7 | 20 | OnGoing |
| GMIT06029 | Molecular Biology 2.2 | E | CA | Lecture CAs | 1,2,3,4 | 20 | OnGoing |
| GMIT06029 | Molecular Biology 2.2 | E | CA | Practical CAs | 2,5,6 | 40 | OnGoing |
| GMIT06028 | Microbiology 2 | E | CA | Online quizzes | 1,2,3,4 | 20 | OnGoing |
| GMIT06028 | Microbiology 2 | E | CA | Laboratory Practical Write-Up and Online Quizzes | 1,3,5,6 | 30 | OnGoing |
| GMIT06030 | Instrumentation 2.1 | E | CA | Class Assessment Assignments/Assessments/Theory quizzes | 1,2,3 | 10 | OnGoing |
| GMIT06030 | Instrumentation 2.1 | E | PRAC | Class Assessment Practical work/Reports | 1,2,4,5 | 30 | OnGoing |
| GMIT06030 | Instrumentation 2.1 | E | PRAC | Practical Evaluation Practical Assessments | 1,2,4,5 | 20 | OnGoing |

Programme Assessment Matrix

Stage 3 Semester 1

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-----------|--|-----|------|--|--------------------------|------------|-----------------|
| MATH07036 | Statistics For Scientists | E | CA | Descriptive Statistics - Practical Exam | 2 | 15 | Week 5 |
| BIO07014 | Bioanalytical Techniques L7 Theory. | E | CA | Multiple Choice Questions | 1,2,3,4 | 15 | Week 6 |
| MCRO07005 | Applied Microbiology And Cleanroom Technology | E | CA | Essay | 1,2,3,4 | 10 | Week 6 |
| PHRM07025 | Pharmaceutical Chemistry | E | CA | Presentation | 1,2,3,4,5 | 10 | Week 6 |
| PHRM07026 | Pharmaceutical Processes And Medical Devices | E | CA | Class Test | 1,2,3,4,5 | 10 | Week 6 |
| MATH07036 | Statistics For Scientists | E | CA | Theory Assessment | 1,3,5 | 15 | Week 8 |
| GMIT07021 | Validation | E | CA | Write a protocol / Test scripts | 5 | 25 | Week 10 |
| BIO07014 | Bioanalytical Techniques L7 Theory. | E | CA | Multiple Choice Questions | 1,2,3,5 | 15 | Week 11 |
| BIOL07015 | Mammalian Cell Culture | E | CA | OSCE | 5 | 20 | Week 12 |
| PHRM07026 | Pharmaceutical Processes And Medical Devices | E | CA | Class Test | 1,2,3,4,5 | 10 | Week 12 |
| MATH07036 | Statistics For Scientists | E | CA | Inferential Statistics - Practical Exam | 4,5,6 | 20 | Week 13 |
| BIO07014 | Bioanalytical Techniques L7 Theory. | E | CA | LAQ | 3,5 | 20 | Week 14 |
| MCRO07005 | Applied Microbiology And Cleanroom Technology | E | EXAM | Final Exam | 1,2,3,4,5,6 | 50 | Week 15 |
| PHRM07025 | Pharmaceutical Chemistry | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | Week 15 |
| MATH07036 | Statistics For Scientists | E | EXAM | End of Term Exam | 1,2,3,4,5,6 | 50 | End of Term |
| PHRM07008 | Pharmaceutical Processing And Medical Device Manufacture | E | EXAM | Final Exam End of term exam | 1,2,3,4,5,6 | 60 | End of Term |
| BIO07014 | Bioanalytical Techniques L7 Theory. | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | End of Semester |
| BIO07022 | Protein Biotechnology | E | CA | Literature Survey | 4,5 | 15 | End of Semester |
| BIO07022 | Protein Biotechnology | E | PROJ | Individual Project Topical Individual Research | 1,2,3,4,5 | 40 | End of Semester |
| BIO07036 | Animal Cell Culture | E | EXAM | Final exam | 1,2,3,4,5,6 | 50 | End of Semester |
| GMIT07022 | Applied Enzymology & Immunology | E | EXAM | Final Exam | 1,2,3,4,5,6,7 | 50 | End of Semester |
| GMIT07017 | Spectrophotometric Methods Of Analysis 3.1 | E | PRAC | Practical Evaluation Laboratory work and laboratory reports submitted weekly | 1,2,3,4,5,6,7 | 50 | End of Semester |
| GMIT07017 | Spectrophotometric Methods Of Analysis 3.1 | E | EXAM | Final Exam 2-hour - written exam on computer | 1,2,3,4,5,6,7 | 40 | End of Semester |
| GMIT07020 | Advanced Molecular And Biochemical Techniques | E | EXAM | Final Written Exam | 1,2,3,5 | 40 | End of Semester |
| GMIT07018 | Microbiological Quality Control | E | EXAM | End of Term Exam (2 hours) | 1,2,3,4,5,6,7 | 60 | End of Semester |

| | | | | | | | |
|-----------|--|---|------|---|---------------|----|-----------------|
| GMIT07021 | Validation | E | CA | Knowledge quiz(es) & Reflections | 1,2,3,4 | 25 | End of Semester |
| GMIT07021 | Validation | E | EXAM | Final Exam | 1,2,3,5 | 50 | End of Semester |
| GMIT07019 | Quality Management Ii | E | EXAM | Final Exam | 1,2,3,4,5,6 | 70 | End of Semester |
| BIO07036 | Animal Cell Culture | E | FO | Quiz | 1,2,3,4,5,6 | 0 | OnGoing |
| BIO07036 | Animal Cell Culture | E | PRAC | Laboratory work | 2,3,4,7,8 | 50 | OnGoing |
| PHRM07008 | Pharmaceutical Processing And Medical Device Manufacture | E | CA | Presentation on processing technology | 3,4,5 | 10 | OnGoing |
| PHRM07008 | Pharmaceutical Processing And Medical Device Manufacture | E | CA | Assignment Short Answer Questions/Multiple Choice Questions/Assignment Work | 1,2,3,4,5,6 | 30 | OnGoing |
| MCRO07005 | Applied Microbiology And Cleanroom Technology | E | CA | Laboratory Practicals | 1,2,3,4,5,6,7 | 40 | OnGoing |
| BIOL07015 | Mammalian Cell Culture | E | CA | Portfolio/Learning Log | 1,2,3,4 | 80 | OnGoing |
| PHRM07025 | Pharmaceutical Chemistry | E | CA | Practical Reports | 1,2,3,4,5,6 | 40 | OnGoing |
| PHRM07026 | Pharmaceutical Processes And Medical Devices | E | CA | Site Visit Reports | 1,2,3,4,5 | 80 | OnGoing |
| GMIT07022 | Applied Enzymology & Immunology | E | CA | Class Assessment Continuous Assessment | 1,2,3,4,5,6,7 | 10 | OnGoing |
| GMIT07022 | Applied Enzymology & Immunology | E | CA | Practical Reports | 8 | 40 | OnGoing |
| GMIT07017 | Spectrophotometric Methods Of Analysis 3.1 | E | CA | Assessment - various online assessments | 1,2,3,4,5,6 | 10 | OnGoing |
| GMIT07020 | Advanced Molecular And Biochemical Techniques | E | CA | Course work - practical assessment and theory CA | 1,2,4 | 60 | OnGoing |
| GMIT07018 | Microbiological Quality Control | E | CA | Coursework- Practical assessment and theory CA | 3,4,5,6,7 | 40 | OnGoing |
| GMIT07019 | Quality Management Ii | E | CA | Course work Assignments and theory CA | 1,2,3,4,5,6 | 30 | OnGoing |
| BIO07022 | Protein Biotechnology | E | CA | Theory quizzes. | 1,2,3 | 45 | Any |
| BIO07022 | Protein Biotechnology | E | FO | Group Project Group \Discussion of Protein Relevant Topics | 1,2,3,4,5 | 0 | Any |

Programme Assessment Matrix

Stage 3 Semester 2

| Code | Module Title | M/E | Type | Description | Module Outcomes Assessed | % of Total | Indicative Week |
|-----------|---|-----|------|---|--------------------------|------------|-----------------|
| PHRM07018 | Pharmaceutical Analysis | E | FO | Short questions and practical assessments | 1,2,3,6,7 | 0 | Week 17 |
| PHRM07018 | Pharmaceutical Analysis | E | CA | Assignment | 2,4,7 | 15 | Week 21 |
| BIO07026 | Biocontamination Control | M | CA | Multiple Choice Questions | 1,2,3,4 | 15 | Week 21 |
| QUAL07007 | Quality And Regulations | E | CA | MCQ | 1,2,3,4 | 10 | Week 21 |
| ENVR07059 | Environmental Analysis | E | CA | Class Test | 1,3,5 | 10 | Week 21 |
| PHRM07018 | Pharmaceutical Analysis | E | PRAC | Independently perform analysis | 6,7 | 10 | Week 26 |
| BIO07026 | Biocontamination Control | M | CA | Multiple Choice Questions | 1,2,3,4,5,6 | 15 | Week 26 |
| QUAL07007 | Quality And Regulations | E | CA | Groups Presentation | 1,2,3,4 | 30 | Week 26 |
| PHRM07027 | Medicinal Drug Analysis | E | CA | Presentation | 1,2,3,4,5 | 5 | Week 26 |
| QUAL07007 | Quality And Regulations | E | CA | MCQ | 1,2,3,4 | 10 | Week 27 |
| PHRM07027 | Medicinal Drug Analysis | E | CA | Practical Exam | 6 | 10 | Week 27 |
| ENVR07059 | Environmental Analysis | E | CA | Field work, practical and presentation | 1,2,3,4,5 | 5 | Week 27 |
| BIO07026 | Biocontamination Control | M | CA | LAQ | 1,2,3,4,5,6 | 20 | Week 29 |
| QUAL07007 | Quality And Regulations | E | EXAM | Final Exam | 1,2,3,4 | 50 | Week 30 |
| PHRM07027 | Medicinal Drug Analysis | E | EXAM | Final Exam | 1,2,3,4,5 | 50 | Week 30 |
| ENVR07059 | Environmental Analysis | E | EXAM | Final Exam | 1,2,3,5 | 50 | Week 30 |
| LAW07026 | Legislation, Quality & Auditing Systems | E | EXAM | Final Exam | 1,2,3,4,5,6 | 60 | End of Term |
| MCRO07004 | Microbial Biotechnology | E | EXAM | Final theory examination. | 1,2,3,4 | 50 | End of Term |
| BIO07026 | Biocontamination Control | M | EXAM | Final Exam | 1,2,3,4 | 50 | End of Term |
| BIOL07013 | Immunodiagnosics | E | EXAM | Final Exam Theory Exam | 1,2,3,4 | 50 | End of Semester |
| PHRM07018 | Pharmaceutical Analysis | E | EXAM | Final Exam | 1,2,3,4,5,7 | 35 | End of Semester |
| GMIT07023 | Placement | E | CA | Placement Report, marked by academic supervisor | 1,2,3,4,5,6,7 | 40 | End of Semester |
| GMIT07023 | Placement | E | CA | Placement Presentation | 1,2,3,4,5,6,7 | 40 | End of Semester |
| BIOL07013 | Immunodiagnosics | E | FO | Quiz | 1,2,3,4 | 0 | OnGoing |
| BIOL07013 | Immunodiagnosics | E | PRAC | Laboratory work | 2,5,6 | 50 | OnGoing |

| | | | | | | | |
|-----------|---|---|----|---|---------------|----|---------|
| LAW07026 | Legislation, Quality & Auditing Systems | E | CA | Assignment Short Answer Questions/Multiple Choice Questions/Assignment Work | 1,2,3,4 | 20 | OnGoing |
| LAW07026 | Legislation, Quality & Auditing Systems | E | CA | Case Study and presentations | 4,5,6 | 20 | OnGoing |
| MCRO07004 | Microbial Biotechnology | E | FO | Self assessment quizzes | 1,2,3,4 | 0 | OnGoing |
| MCRO07004 | Microbial Biotechnology | E | CA | Practical Evaluation Practicals /workshops | 1,2,3,4,5 | 50 | OnGoing |
| PHRM07018 | Pharmaceutical Analysis | E | CA | Laboratory Reports | 3,5,6,7 | 40 | OnGoing |
| PHRM07027 | Medicinal Drug Analysis | E | CA | Laboratory Practicals | 1,2,3,4,5 | 35 | OnGoing |
| ENVR07059 | Environmental Analysis | E | CA | Laboratory Practicals | 1,2,3,4,5 | 35 | OnGoing |
| GMIT07023 | Placement | E | CA | Placement Performance Grade, marked by industrial mentor | 1,2,3,4,5,6,7 | 20 | OnGoing |

Approved Modules

| Stage | Approved Modules | New Modules |
|-------|--|--|
| 1 | MATH06078 Applied Mathematics PHYS06005 MEASUREMENT SCIENCE GMP06003 CALIBRATION SCIENCE | SCI06023 Biology 1 SCI06025 Chemistry 1 SCI06029 Essential Skills for Scientists SCI06027 Information Technology 1 SCI06024 Biology 2 SCI06026 Chemistry 2 SCI06028 Information Technology 2 SCI06021 Introduction to Industrial Laboratory Science SCI06020 Laboratory Science Skills |
| 2 | BIO06028 Analytical Techniques BIOC06008 BIOCHEMISTRY 1 MATL06007 BIOMATERIALS AND MEDICAL DEVICES MCRO06001 MICROBIOLOGY SAFE06023 ENVIRONMENT HEALTH AND SAFETY BIO06006 MEDICAL IMMUNOLOGY BIOL06017 Molecular Biology MCRO06002 PROCESS MICROBIOLOGY SCI06019 Job Readiness (Science) | SCI06022 Laboratory Professional Practice CHEM06051 Instrumentation 1 BIOC06013 Biochemistry DRUG06001 Medicinal Drug Discovery and Design ECOL06010 Ecosystems INST06006 Instrumentation 2 MCRO06016 Fundamentals of Microbiology GMIT06022 Biochemistry GMIT06023 Analytical Techniques 2.1 GMIT06024 Molecular Biology 2.1 GMIT06026 Microbiology 1 GMIT06021 Data Modelling and Statistics GMIT06025 Quality Management I GMIT06027 Analytical Techniques 2.2 GMIT06029 Molecular Biology 2.2 GMIT06028 Microbiology 2 GMIT06030 Instrumentation 2.1 GMIT07016 Six Sigma for Quality Management |
| 3 | BIO07014 Bioanalytical Techniques L7 Theory. BIO07022 PROTEIN BIOTECHNOLOGY BIO07036 Animal Cell Culture MATH07036 STATISTICS FOR SCIENTISTS PHRM07008 Pharmaceutical Processing and Medical Device Manufacture BIOL07013 Immunodiagnostics LAW07026 Legislation, Quality & Auditing Systems MCRO07004 Microbial Biotechnology PHRM07018 PHARMACEUTICAL ANALYSIS BIO07026 BIOCONTAMINATION CONTROL | MCRO07005 Applied Microbiology and Cleanroom Technology BIOL07015 Mammalian Cell Culture PHRM07025 Pharmaceutical Chemistry PHRM07026 Pharmaceutical Processes and Medical Devices QUAL07007 Quality and Regulations PHRM07027 Medicinal Drug Analysis ENVR07059 Environmental Analysis GMIT07022 Applied Enzymology & Immunology GMIT07017 Spectrophotometric Methods of Analysis 3.1 GMIT07020 Advanced Molecular and Biochemical Techniques GMIT07018 Microbiological Quality Control GMIT07021 Validation GMIT07019 Quality Management II GMIT07023 Placement |



Stage 1 Modules

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Biology 1 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Dr. Oliver Joyce, Margaret Doherty, Neville McClenaghan | | |

Module Description

The module aims to introduce learners to the structure and function of the major biological macromolecules of the cell. The module also introduces learners to the structure and functions of eukaryotic and prokaryotic cells.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe the structures and functions of eukaryotic cells, prokaryotic cells, and cell organelles.
2. Explain how cell division occurs.
3. Describe the structure and function of biological macromolecules.
4. Perform and report on, biological laboratory experiments and communicate information accurately and effectively using written, visual, and numeral forms.

Indicative Syllabus

Describe the structures and functions of eukaryotic cells, prokaryotic cells, and cell organelles

- Typical Bacterial structure
- Eukaryotic Cell organelle structure and function
- Eukaryotic membrane structure
- Transport across membranes

Explain how cell division occurs

- Binary Fission
- Mitosis
- Meiosis

Describe the structure and function of biological macromolecules

- Structure and function of carbohydrates
- Structure and function of lipids
- Structure and function of proteins
- Structure and function of nucleic acids

Perform and report on, biological laboratory experiments and communicate information accurately and effectively using written, visual, and numeral forms

- Report writing
- Manipulation of data
- Plotting experimental data
- Assessment of practical skills

Teaching and Learning Strategy

The Biology 1 module will be delivered full time and will include lectures, and laboratory practicals. An online repository of educational resources and as a means of assessment will be used where appropriate.

Assessment Strategy

The Biology 1 module is 50% Practical and 50% Theory.

Laboratory skills and report-writing ability are assessed as part of the practical work performed during the module (50%). There will be two MCQs (15%) and a Final Exam (35%).

Attendance Requirement: 75% Minimum

The student must reach an assigned gate of 25% in the final exam and achieve 40% overall to pass the subject.

Repeat Assessment Strategies

Repeat Continuous Assessment and/or Final Exam.

Additional Facilities

Indicative Coursework and Continuous Assessment:

65 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-----------------------------------|---|---------|-------------------|-------------------|
| Assessment | Practical skills evaluation, written laboratory reports | 50 % | OnGoing | 4 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | OnGoing | 1,2,3 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 0 % | OnGoing | 1,2,3 |

End of Semester / Year Formal Exam:

35 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|------------|---------|-------------------|-------------------|
| Closed Book Exam | Final Exam | 35 % | End of Semester | 1,2,3 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|-------|-----------|
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2.5 | Weekly |
| Independent Learning | Self-Study | Not Specified | 1.5 | Weekly |

Required Reading Book List

Reece, B., Taylor, R., Simon, J., Dickey, L., Hogan, A., (2015). *Campbell Biology*. Benjamin Cummings.
ISBN 0321885325 ISBN-13 9780321885326

Recommended Reading Book List

Windelspecht, M., Mader, S., (2015). *Mader, Biology, AP Edition*. McGraw-Hill Education.
ISBN 0076739937 ISBN-13 9780076739936

Literary Resources

Journal Resources

Online Resources

Other Resources

Relevant online and other resources as directed.

Programme Membership

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Chemistry 1 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Declan Shelly, Margaret Doherty, Neville McClenaghan | | |

Module Description

This module introduces students to general fundamentals of chemistry, including atomic theory, bonding, solution concentration, pH, stoichiometry, oxidation, and reduction through a combination of theory and practical work.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Use the periodic table to define and describe atoms, ions, molecules, and bonding.
2. Interpret solution concentrations and perform calculations to illustrate the relationship between the units used.
3. Balance chemical equations and calculate reaction yields.
4. Identify and explain the difference between acidity and basicity of solutions.
5. Solve a range of practical problems through the safe use of chemical equipment and techniques.
6. Communicate by written and verbal means, the results of theory and practical based exercises in a logical and coherent fashion.

Indicative Syllabus

The periodic table and the use of atomic weight and atomic number.
 Definition and explanation of the structure of a range of atoms, ions, and molecules.
 The concept of the mole as a unit in chemical calculations.
 Concentrations of aqueous solutions and the relationships between the various units of measure.
 Definition of acids, bases, and the use of the pH scale.
 Chemical bonding and the difference between covalent and ionic bonds.
 Chemical formulae and balancing chemical equations - Stoichiometry.
 Oxidation and Reduction - Redox reactions.
 Chemistry of the main group elements.

Teaching and Learning Strategy

This module will be delivered full-time. It will include lectures and laboratory practicals. This approach is expected to address student learning needs. An online repository of educational resources will be used as appropriate and as a means of assessment.

Assessment Strategy

Students will be assessed using a range of multiple-choice questions. Further assessment methods include laboratory performance and end of year examination.
 Attendance Requirement: 75% Minimum
 The student must reach a minimum of 25% grade in the final exam and achieve 40% overall in order to pass the module.

Repeat Assessment Strategies

Students may repeat Continuous Assessment and / or Final Theory Exam as required.

| |
|------------------------------|
| Additional Facilities |
|------------------------------|

| | | | | |
|---|---------------------------|----------------|--------------------------|--------------------------|
| Indicative Coursework and Continuous Assessment: | | 65 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Self-Assessment Quizzes | 0 % | OnGoing | 1,2,3,4,5,6 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | OnGoing | 1,2,3,4,6 |
| Skills Evaluation | Laboratory Practical | 50 % | OnGoing | 2,3,4,5,6 |

| | | | | |
|--|--------------|----------------|--------------------------|--------------------------|
| End of Semester / Year Formal Exam: | | 35 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 35 % | End of Semester | 1,2,3,4 |

| | | | | |
|---------------------------------|----------------------|--------------------|--------------|------------------|
| Full Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2.5 | Weekly |
| Independent Learning | Self-Study | Not Specified | 1.5 | Weekly |

| |
|---|
| Required Reading Book List |
| (2021). <i>CHEMISTRY</i> . ISBN 1292407603 ISBN-13 9781292407609 |

| |
|--|
| Recommended Reading Book List |
| Ebbing, D., Gammon, D., (2016). <i>General Chemistry</i> . Cengage Learning. ISBN 1305580346 ISBN-13 9781305580343 |
| Masterton, L., Hurley, N., (2015). <i>Chemistry: Principles and Reactions</i> . Cengage Learning. ISBN 130507937X ISBN-13 9781305079373 |

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|---------------------------|
| Literary Resources |
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| Journal Resources |
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|-------------------------|
| Online Resources |
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| Other Resources |
| Relevant online and other resources as directed. |

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|-----------------------------|
| Programme Membership |
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| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Essential Skills for Scientists | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Margaret Doherty, Elizabeth Carroll, Neville McClenaghan | | |

Module Description

The aim of this module is to introduce the students to essential skills required by scientists in the 21st century, as well as equip undergraduates with the strategies to cope with the style of learning and enquiry required for success in higher education. A strong emphasis will be placed on the transferable skills that are highly valued by employers. In particular, the module will focus on metacognition and the development of academic writing, communication, and interpersonal competencies. The module aims to motivate students to take responsibility for their own learning through self-driven enquiry, provide them with the skills for a lifetime of independent and reflective learning and ultimately better prepare them for employment and the career ladder.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Analyse time management skills and manage time effectively with regard to planning and organising tasks.
2. Communicate scientific knowledge to a variety of audiences.
3. Understand the principals of scientific reporting, recognise the importance of academic integrity and identify ways of avoiding plagiarism in academic work through appropriate referencing.
4. Demonstrate an ability to work professionally as an individual or as a member of a team.
5. Recognise different learning styles, identify personal strengths and weaknesses as a learner and apply appropriate learning strategies to develop study skills.

Indicative Syllabus

Analyse time management skills and manage time effectively with regard to planning and organising tasks.

- Time management
- Organisational skills
- Project planning
- Team working skills
- Self-organisation and goal setting

Communicate scientific knowledge to a variety of audiences.

- Professional oral communication skills
- Communicating science in a technical manner
- Communicating science in a non-technical manner
- Team work – effective communication as part of a team; facilitating discussions at meetings

Understand the principals of scientific reporting, recognise the importance of academic integrity and identify ways of avoiding plagiarism in academic work through appropriate referencing.

- Scientific report writing – technical writing
- Communicating science in non-technical language
- Data presentation, structuring, paraphrasing, summarising
- Referencing
- Plagiarism

Demonstrate an ability to work professionally as an individual or as a member of a team.

- Personal and professional development planning
- Career path planning (link between study and chosen career noting diverse range of roles and jobs in the Life Sciences sector)
- Goal setting
- Team work
- Conflict Management skills to include: communications process, strategies to manage low level interpersonal team issues; empathetic listening, assertiveness

Recognise different learning styles, identify personal strengths and weaknesses as a learner and apply appropriate learning strategies to develop study skills.

- VARK (Visual, Auditory/Aural, Read/Write, Kinesthetic)
- Multimodal learner
- Collaborative learning
- Self-directed learning
- Critical thinking skills
- Problem solving/enquiry-based learning

Teaching and Learning Strategy

Essential skills for scientists will be delivered full-time, using mainly interactive workshops and group-based formats. A student-centered approach will be adopted to stimulate and motivate students, encouraging them to develop a deeper understanding as well as promote both independent and collaborative learning. Students are recommended to undertake a VARK questionnaire to discover whether they are a visual, auditory/aural, read/write, kinesthetic or multimodal learner. This will enable them to recognise the types of study skills they need to acquire to achieve independent/self-directed learning at third level. Reflection strategies will be introduced to allow students to identify gaps in their knowledge, discuss and consider changes in their understandings, skills, attitudes and values. This reflection and self-explanation will lead to a deeper understanding of the material and ultimately promote knowledge transfer. Collaborative and active learning will be fostered, whereby students will work in teams to research a chosen topic and communicate the outcomes of the project to an audience. Online content such as videos, e-portfolios, goal setting templates, referencing software, databases etc. will be used as appropriate. A learning platform can be used as a repository of educational resources and as a means of assessment (e.g. uploading assignments and journals).

Assessment Strategy

Essential skills for scientists will be examined through 100% continuous assessment. The focus of this module is to develop the undergraduate's transferable skills that are highly valued by employers.

Students will produce a personal development portfolio which will encourage them to reflect on their learning style, time management and self-organisational skills. To develop teamwork skills, students will work in small groups on a chosen project to produce a written report and oral presentation. In small group sizes, the lecturer will observe the students demonstrating skills (e.g., collaboratively working, conflict management) and provide formative feedback.

Assessment of the team project will also include an individual personal reflection (as part of the personal development portfolio). Development of academic writing is a key focus of this module and as such students will be required to produce a short technical report that is properly structured and referenced.

Repeat Assessment Strategies

If a student fails to achieve 40% in the module, they will be required to submit an assignment. Repeat assessments will be decided on a case-by-case basis and will be informed by the amount and quality of continuous assessment submitted during the semester. Examples of repeat assessment could include a multiple-choice quiz, case study evaluation or essay style questions on a given topic.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 100 % | | |
|--|---------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Formative Assessments | 0 % | OnGoing | 1,2,3,4,5 |
| Written Report/Essay | Scientific Report | 25 % | OnGoing | 3,5 |
| Group Project | Group Project | 25 % | OnGoing | 2,3,4 |
| Assessment | Presentation | 25 % | OnGoing | 1,2,3,4 |
| Individual Project | Personal Development Plan | 25 % | OnGoing | 1,4,5 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|--|----------------|-------|-----------|
| Practical / Laboratory | Group Work and Learning/Problem Based Learning | Flat Classroom | 2 | Weekly |
| Independent Learning | Self-Study and Group Work | Not Specified | 5 | Weekly |

Recommended Reading Book List

Moran, A., (2018). *Managing Your Own Learning at University*. 3rd Edition. University College Dublin Press.
ISBN 1910820261 ISBN-13 9781910820261

Cottrell, S., (2021). *Skills for Success*. Red Globe Press.
ISBN 9781352011593 ISBN-13 135201159X

Cottrell, S., (2023). *Critical Thinking Skills*. Bloomsbury Study Skills.
ISBN 9781350322585 ISBN-13 135032258X

Cottrell, S., (2019). *The Study Skills Handbook*. Bloomsbury Publishing.
ISBN 9781137610874 ISBN-13 1137610875

Glasman-Deal, H., (2020). *Science Research Writing*. Wspc (Europe).
ISBN 1786347849 ISBN-13 9781786347848

Goleman, D., (2014). *What Makes a Leader*.
ISBN 1934441740 ISBN-13 9781934441749

Day, T., (2018). *Success in Academic Writing*. Red Globe Press.
ISBN 9781352002041 ISBN-13 1352002043

Literary Resources

Journal Resources

Online Resources

Other Resources

Vark-learn.com. (2019). VARK | a guide to learning preferences. [online] Available at: <http://vark-learn.com/>

Tom, B. and Sandra, S. (2019). *Essential Study Skills: The Complete Guide to Success at University* | SAGE Companion. [online] Study.sagepub.com. Available at: <https://study.sagepub.com/burnsandsinfield4e>

Additional reading and resources will be recommended by the lecturer.

Programme Membership

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Information Technology 1 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Akinlolu Akande, Margaret Doherty, Neville McClenaghan | | |

Module Description

This module deals with the practical applications of Information Technology. It serves as an introduction to the computer systems the student will use while taking their chosen course in the college. It also covers the fundamental skills of word processing, presentation, and spreadsheet software.

The teaching methods used will be a combination of lectures, self-study, labs, problem-solving exercises, and computer-based learning.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Use the IT infrastructure and virtual learning environment to perform standard IT tasks to assist in their future studies.
2. Identify the main component parts and peripheral devices of a standard computer system.
3. Create documentation using word processing software incorporating a range of data management and editing techniques.
4. Produce a professional presentation using presentation software.
5. Compile and edit data sets using spreadsheet software to include formulae, chart construction, and object linking.

Indicative Syllabus

Introduction to Computer Systems

- Email
- Use a Virtual Learning Environment to access module notes, complete multiple choice questions (MCQs) and upload content
- Network Drive and Cloud for File Storage
- Printing

Computers and their peripheral devices

- Component parts of a computer
- Input/Output Devices

Word Processing - Microsoft Word (Desktop and Online Version)

- Document creation, document structure and formatting
- Insertion of tables and images to a document
- Insert mathematical and scientific equations and chemical symbols into a word document
- Use of spell checker and the track changes functionality
- Insertion of tables of contents, citations and tables of references
- Introduction of MS Office Live

Presentation - Microsoft PowerPoint (Desktop and Online Version)

- Fundamental rules in creating a presentation using software
- Apply a design to a presentation
- Apply animation to a presentation
- Use the master slide to alter the design of a presentation
- Integrate images, diagrams and other media into a presentation

Spreadsheets - Microsoft Excel

- Input data into a spreadsheet
- Perform basic calculations using formulae
- Use the SUM, AVERAGE, MAX, MIN and COUNT functions to perform calculations
- Produce relevant charts to describe a data set (Column, Bar, Line and Pie Charts)
- Format data in a spreadsheet for printing as a report

Teaching and Learning Strategy

The teaching methods used will be a combination of lectures, self-study, labs, problem-solving exercises, and computer-based learning.

Assessment Strategy

This module will be assessed by means of practical activities done in the computer laboratory during the weekly practical sessions, assignments in the word processing and presentation sections which will be completed during the students independent learning. There will also be a computer laboratory-based assessment at the end of the module to ensure the student has met the learning outcomes and has taken on board the feedback given during the weekly practical sessions and the assignments already completed.

Repeat Assessment Strategies

Where the module mark is below 40% and attendance is below the 75% requirement, the student must repeat attend the module.

Where the deficit is only in the module mark, the student will be asked to attend a practical assessment.

Additional Facilities**Indicative Coursework and Continuous Assessment:****100 %**

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-----------------------------------|--|----------------|--------------------------|--------------------------|
| Skills Evaluation | Practical Evaluation Weekly Class Activities | 10 % | OnGoing | 1,2,3,4,5 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions (MCQs) | 15 % | OnGoing | 2,3,4,5 |
| Assignment | Assignment Creation of a Report in MS Word | 25 % | OnGoing | 3 |
| Assignment | Assignment Creation of a Presentation in MS PowerPoint | 20 % | OnGoing | 4 |
| Skills Evaluation | End of Module Practical Evaluation covering Presentations and Spreadsheets | 30 % | OnGoing | 4,5 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|---------------------|--------------|------------------|
| Practical / Laboratory | Laboratory Practical | Computer Laboratory | 2 | Weekly |
| Independent Learning | Self-Study | Not Specified | 5 | Weekly |

Required Reading Book List

O'Leary, D., O'Leary, L., O'Leary, T., (2014). *Computing Essentials 2015 Complete Edition*. McGraw-Hill Education.
ISBN 0073516899 ISBN-13 9780073516899

Recommended Reading Book List

Adam, R., (2023). *The Complete Guide to Microsoft Office 365 for Beginners*. Independently Published.
ISBN 9798388605948

Rowling, J., (2023). *Microsoft Office 365 For Beginners: The Ultimate, Complete and Comprehensive Detailed User Manual Guide To Becoming A Pro and Expert In Office 365, Excel, Spreadsheet, And PowerPoint As a Beginner*. 1st Edition. Independently published.

Literary Resources**Journal Resources****Online Resources****Other Resources****Programme Membership**

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Applied Mathematics | | |
| Status | Uploaded to Banner | Start Term | 2018 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | David Doyle | | |

Module Description

This module introduces students to the mathematical and numeric skills they need as scientists. The focus of the module is on understanding and practising the basic methods and techniques of scientific mathematics while emphasising their real world and scientific application.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Perform basic calculations involving integers, fractions, decimals, powers and scientific notation without the use of a calculator.
2. Perform calculations involving ratios, percentages and error.
3. Perform unit conversions, express values in SI units and solve related pharmaceutical and real world problems.
4. Use algebra to solve equations and to manipulate mathematical expressions and formulae.
5. Be able to organise and present data in suitable formats and perform basic statistical analysis of this data.

Indicative Syllabus

Perform basic calculations involving integers, fractions, decimals, powers and scientific notation without the use of a calculator.

- Basic operations
- BODMAS
- Plus and minus
- Decimals
- Fractions,
- Decimal places & significant figures
- Powers
- Scientific notation
- Order of magnitude.

Perform calculations involving ratios, percentages and error .

- Ratios
- Percentage calculations
- Absolute and relative percentage difference
- Percentage error calculations.

Perform unit conversions, express values in SI units and solve related pharmaceutical and real world problems.

- SI units,
- Prefixes (T, G M, k, m, μ , n, p etc)
- Unit conversions
- Related real world problems
- Pharmaceutical quantities
- Moles & molarity.

Use algebra to solve equations and to manipulate mathematical expressions and formulae.

- Algebra laws
- Factorising
- Multiplying out brackets
- Solving linear and quadratic functions
- Formula manipulation

Be able to organise and present data in suitable formats and perform basic statistical analysis of this data.

- Statistics and data handling
- Discrete and continuous variables
- Measures of central tendency and dispersion

- Cumulative frequency tables and ogives

Teaching and Learning Strategy

This module is delivered online.

It is taught in a "flipped classroom" format. Students study online using Moodle based notes, videos and quizzes. Each week, there is an online live tutorial where students queries are answered and problems relevant to the current topic are worked out and discussed.

Assessment Strategy

Course work

10% - Students need to achieve 100% in each of the online quizzes (pro rata)

2 x 15% - Students have two online exams based on the Moodle quizzes. These take place in early November and early December.

60% Final exam

Repeat Assessment Strategies

Repeat Continuous Assessment and/or Final Exam

Additional Facilities

Final Examination centre

Remote proctoring facilities will be required.

| Indicative Coursework and Continuous Assessment: | | 40 % | | |
|--|----------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Online Quizzes | 10 % | OnGoing | 1,2,3,4,5 |
| Assessment | CA test 1 | 15 % | Week 7 | 1,2,3 |
| Assessment | CA test 2 | 15 % | Week 12 | 4,5 |

| End of Semester / Year Formal Exam: | | 60 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 60 % | End of Term | 1,2,3,4,5 |

| Online Learning Delivery Mode: | | | | |
|--------------------------------|----------------------|---------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Online lecture | Not Specified | 2 | Weekly |
| Independent Learning | Independent learning | Not Specified | 5 | Weekly |

Required Reading Book List

Jordan, S., (2012). *Maths for Science*. OUP Oxford.
ISBN 0199644969 ISBN-13 9780199644964

Literary Resources

None

Journal Resources

None

Online Resources

[Applied Maths Moodle page](#)

[Kahn Academy](#)

Other Resources

None

Programme Membership

SG_SAPMS_H08 202000 Bachelor of Science (Honours) in Applied Medical Sciences

SG_SBIOM_H08 202000 Bachelor of Science (Honours) in Biomedical and BioIndustrial Sciences

| | | | |
|----------------------|---------------------|-----------------------|--------------------|
| Full Title | MEASUREMENT SCIENCE | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Stage - (30 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eileen Armstrong | | |
| Co Authors | Aodhmar Cadogan | | |

Module Description

The principle topics are mechanics, materials, electricity.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain physical laws and definitions of mechanics, materials, electricity.
2. Solve numerical problems in materials, mechanics and electricity.
3. Describe situations where specified principles occur in nature.
4. List appropriate standard units and manipulate them.

Indicative Syllabus

Materials
Mechanics
Electricity

Teaching and Learning Strategy

This module is delivered online via a variety of virtual learning platforms and software. The module will be taught using lectures supported by other electronic resources for use during independent self-directed learning and directed learning.

Assessment Strategy

Continuous Assessment and Final Examination

Repeat Assessment Strategies

As per ATU Sligo procedures

Additional Facilities

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| Indicative Coursework and Continuous Assessment: | | 40 % | | |
|--|-----------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Mathematical problems | - % | OnGoing | 1,2,3,4 |
| UNKNOWN | Short questions | 40 % | OnGoing | 1,2,3,4 |
| End of Semester / Year Formal Exam: | | 60 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Final Exam | 60 % | End of Term | 1,2,3,4 |

| Part Time Delivery Mode: | | | | |
|---------------------------------|--------------------|-----------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Not Specified | 2 | Weekly |

| Required Reading Book List |
|--|
| Cutnell, D., Johnson, W., Young, D., Stadler, S., (2021). <i>Physics, Volume 2</i> . John Wiley & Sons. ISBN 9781119803775 ISBN-13 1119803772 |

| Recommended Reading Book List |
|---|
| Cutnell, D., (2021). <i>Physics</i> . 12 th Edition. John Wiley & Sons. ISBN 1119773539 ISBN-13 9781119773535 |
| Ling, J., (19). <i>University Physics (Ebook)</i> . 1 st Edition. OpenStax. ISBN 1506698166 ISBN-13 9781506698168 |

| Literary Resources |
|---|
| Cutnell, John D., Johnson, Kenneth W., Young, David, and Stadler, Shane, <i>Introduction to Physics</i> , 10th Ed., Wiley & Sons Inc. [ISBN: 978-1-118-65152-0] |

| Journal Resources |
|--------------------------|
| None |

| Online Resources |
|--------------------------------|
| Available yearly from lecturer |

| Other Resources |
|--|
| Communicated by lecturer on a semester basis |

| Programme Membership |
|-----------------------------|
| |

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Biology 2 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Dr. Oliver Joyce, Margaret Doherty, Neville McClenaghan | | |

Module Description

The module introduces the structures and functions of the different organ systems of the body.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Outline the structure of the body systems.
2. Describe the function of the digestive, renal, respiratory, and cardiovascular systems.
3. Describe the function of the nervous, endocrine, and reproductive systems.
4. Perform and report on, biological laboratory experiments and communicate information accurately and effectively using written, visual, and numeral forms.

Indicative Syllabus

Outline the structure of the body systems.

- Nervous
- Endocrine
- Cardiovascular
- Lymphatic
- Respiratory
- Digestive
- Urinary
- Reproductive System

Describe the function of the digestive, renal, respiratory, and cardiovascular systems.

- Describe the function of the digestive system
- Describe the function of the renal system
- Describe the function of the respiratory system
- Describe the function of the cardiovascular system

Describe the function of the nervous, endocrine, and reproductive systems.

- Describe the function of the nervous system
- Describe the function of the endocrine system
- Describe the function of the male reproductive system
- Describe the function of the female reproductive system

Perform and report on, biological laboratory experiments and communicate information accurately and effectively using written, visual, and numeral forms.

- Report writing
- Manipulation of data
- Plotting experimental data
- Assessment of practical skills

Teaching and Learning Strategy

The Biology 2 module will be delivered full-time and will include lectures, laboratory practicals. An online repository of educational resources and as a means of assessment will be used where appropriate.

Assessment Strategy

The Biology 2 module is 50% Practical and 50% Theory.

Laboratory skills and report-writing ability are assessed as part of the practical work performed during the module (50%). There will be two MCQs (15%) and there will be a Final Exam (35%).

Attendance Requirement: 75% Minimum.

The student must reach an assigned gate of 25% in the final exam and achieve 40% overall to pass the subject.

Repeat Assessment Strategies

Repeat Continuous Assessment and/or Final Exam.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 65 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Practical skills evaluation, written laboratory reports | 50 % | OnGoing | 4 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | OnGoing | 1,2,3 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 0 % | OnGoing | 1,2,3 |

| End of Semester / Year Formal Exam: | | 35 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 35 % | End of Semester | 1,2,3 |

| Full Time Delivery Mode: | | | | |
|--------------------------|----------------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2.5 | Weekly |
| Independent Learning | Self-Study | Not Specified | 1.5 | Weekly |

| Recommended Reading Book List |
|---|
| Reece, B., Taylor, R., Simon, J., Dickey, L., Hogan, A., (2015). <i>Campbell Biology</i> . Benjamin Cummings. ISBN 0321885325 ISBN-13 9780321885326 |
| Windelspecht, M., Mader, S., (2015). <i>Mader, Biology, AP Edition</i> . McGraw-Hill Education. ISBN 0076739937 ISBN-13 9780076739936 |

| Literary Resources |
|--------------------|
| |

| Journal Resources |
|-------------------|
| |

| Online Resources |
|------------------|
| |

| Other Resources |
|--|
| Relevant online and other resources as directed. |

| Programme Membership |
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 SCI06026 2023
 Chemistry 2

Mandatory Delivered in Stage 1 Semester 2

| | | | |
|---|---|-----------------------|-----------------------|
| Full Title | Chemistry 2 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Declan Shelly, Margaret Doherty, Neville McClenaghan | | |
| Module Description | | | |
| This module introduces student to fundamentals of Organic Chemistry and Physical Chemistry through a combination of theory and practical work. | | | |
| Learning Outcomes <i>On completion of this module the learner will/should be able to:</i> | | | |
| 1. | Describe the structural characteristics of the various homologous series and functional groups. | | |
| 2. | Outline the chemical reactivity of different families of organic compounds. | | |
| 3. | Explain the basic principles of kinetic theory and gas laws. | | |
| 4. | Identify the factors which affect the rate of a chemical reaction. | | |
| 5. | Solve a range of practical problems through the safe use of chemical equipment and techniques. | | |
| 6. | Communicate by written and verbal means, the results of theory and practical based exercises in a logical and coherent fashion. | | |
| Indicative Syllabus | | | |
| Introduction to Organic Chemistry. Draw and name a range of organic molecules. Illustrate the difference between the reactivity of the various homologous series based on their functional groups. Introduction to Physical Chemistry. Kinetic Theory of Gases. Reaction Rates. Thermochemistry. | | | |
| Teaching and Learning Strategy | | | |
| This module will be delivered full-time. It will include lectures and laboratory practicals. This approach is expected to address student learning needs. An online repository of educational resources will be used as appropriate and as a means of assessment. | | | |
| Assessment Strategy | | | |
| Students will be assessed using a range of multiple-choice questions. Further assessment methods include laboratory performance and end of year examination. Attendance Requirement: 75% Minimum. The student must reach a 25% minimum grade in the final exam and achieve 40% overall in order to pass the module. | | | |
| Repeat Assessment Strategies | | | |
| Students may repeat Continuous Assessment and / or Final Theory Exam as required. | | | |
| Additional Facilities | | | |
| | | | |
| Indicative Coursework and Continuous Assessment: | | 65 % | |

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-----------------------------------|---------------------------|----------------|--------------------------|--------------------------|
| Multiple Choice/Short Answer Test | Self-Assessment Quizzes | 0 % | OnGoing | 1,2,3,4,5,6 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | OnGoing | 1,2,3,4,6 |
| Skills Evaluation | Laboratory Practical | 50 % | OnGoing | 1,2,3,4,5,6 |

| End of Semester / Year Formal Exam: | | 35 % | | |
|--|--------------|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 35 % | End of Semester | 1,2,3,4 |

| Full Time Delivery Mode: | | | | |
|---------------------------------|----------------------|--------------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2.5 | Weekly |
| Independent Learning | Self-Study | Not Specified | 1.5 | Weekly |

| Recommended Reading Book List |
|--|
| Ebbing, D., Gammon, D., (2016). <i>General Chemistry</i> . Cengage Learning. ISBN 1305580346 ISBN-13 9781305580343 |
| Masterton, L., Hurley, N., (2015). <i>Chemistry: Principles and Reactions</i> . Cengage Learning. ISBN 130507937X ISBN-13 9781305079373 |
| (2021). <i>CHEMISTRY</i> . ISBN 1292407603 ISBN-13 9781292407609 |

| Literary Resources |
|---------------------------|
| |

| Journal Resources |
|--------------------------|
| |

| Online Resources |
|-------------------------|
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| Other Resources |
|--|
| Relevant online and other resources as directed. |

| Programme Membership |
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| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Information Technology 2 | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Akinlolu Akande, Margaret Doherty, Neville McClenaghan | | |

Module Description

This module deals with advanced practical applications of Information Technology. It covers the software packages for spreadsheets, desktop publishing, digital notebooks, and data management.

The teaching methods used will be a combination of lectures, self-study, labs, and any combination of discussion, case study, problem-solving exercises, and computer-based learning.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Model problems using advanced features of Excel and build on concepts learned in Information Technology 1.
2. Create a poster to illustrate the results of a scientific project using an appropriate software package.
3. Demonstrate proficient use of digital notebook.
4. Use online cloud tools and other software packages for data management and collaboration.

Indicative Syllabus

Advanced Spreadsheets

- Advanced Charting
- Logical Functions
- Working with large datasets

Desktop Publishing

- Creating an academic poster

Digital Notebooks

- OneNote

Data Management

- Cloud Infrastructure: Online Collaborative tools
- Databases

Teaching and Learning Strategy

The teaching methods used will be a combination of lectures, self-study, labs, and any combination of discussion, case study, problem-solving exercises, and computer-based learning.

Assessment Strategy

As part of the summative assessment, the learner will complete assignments in desktop publishing and use of digital notebooks which will be completed during the students independent learning. There will also be computer laboratory-based assessments which will assess the students' practical application of skills in relation to using advanced spreadsheet functionality and data management techniques.

The learner will also undergo formative assessment by means of practical activities done in the computer laboratory during the weekly practical sessions. They will be given assistance and feedback during the completion of these activities which they can then put into practice when undertaking summative assessment.

Repeat Assessment Strategies

Where the module mark is below 40% and attendance is below the 75% requirement, the student must repeat attend the module.

Where the deficit is only in the module mark, the student will be asked to attend a practical assessment.

Additional Facilities

Indicative Coursework and Continuous Assessment:

100 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|---|----------------|--------------------------|--------------------------|
| Skills Evaluation | Practical Evaluation Weekly Class Activities | 10 % | OnGoing | 1,2,3,4 |
| Skills Evaluation | Data Management Assessment | 20 % | OnGoing | 4 |
| Assignment | Desktop Publishing Assignment | 20 % | OnGoing | 2 |
| Skills Evaluation | Advanced Excel Assessment | 30 % | OnGoing | 1 |
| Skills Evaluation | Online Collaborative Tools and Digital Notebook | 20 % | OnGoing | 3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|---------------------|--------------|------------------|
| Practical / Laboratory | Laboratory Practical | Computer Laboratory | 2 | Weekly |
| Independent Learning | Self-Study | Not Specified | 5 | Weekly |

Recommended Reading Book List

O'Leary, D., O'Leary, L., O'Leary, T., (2014). *Computing Essentials 2015 Complete Edition*. McGraw-Hill Education.
ISBN 0073516899 ISBN-13 9780073516899

Adam, R., (2023). *The Complete Guide to Microsoft Office 365 for Beginners*. Independently Published.
ISBN 9798388605948

Rowling, J., (2023). *Microsoft Office 365 For Beginners: The Ultimate, Complete and Comprehensive Detailed User Manual Guide To Becoming A Pro and Expert In Office 365, Excel, Spreadsheet, And PowerPoint As a Beginner*. 1st Edition. Independently published.

Literary Resources

Journal Resources

Online Resources

Other Resources

Programme Membership

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Introduction to Industrial Laboratory Science | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Margaret Doherty, Neville McClenaghan | | |

Module Description

In this module the student will be introduced to the ever-evolving area of Industrial Laboratory Science. The student will build an understanding of the life sciences industry, encompassing industrial pharmaceutical science, bioindustry, medical device and laboratory-focussed sectors.

The module will consider historical aspects and current technological developments of scientific, economic, and social importance as well as emerging and future technologies.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe industrial laboratory science within the context of life sciences.
2. Briefly describe the history and developments of key technologies in laboratory science.
3. Identify safety, ethical, regulatory and propriety aspects of life sciences.
4. Demonstrate knowledge of applied laboratory science and communicate information accurately and effectively.

Indicative Syllabus

1. Introduction to industrial laboratory science within the context of life sciences.
2. Origin and evolution of laboratory science technologies: historical milestones.
3. Overview of diagnostic and therapeutic industries (noting the diverse range of roles and jobs in the Life Sciences sector).
4. Overview of industry laboratories (Research and Development Lab, Diagnostic Testing Lab, Product Testing Lab).
5. Introduction to laboratory testing (Water/Utilities, Environmental, Product Testing).
6. Introduction to laboratory safety and Good Laboratory Practice (GLP).
7. Ethical aspects in life sciences.
8. Introduction to regulation in laboratory sciences.
9. Innovation and proprietary aspects of laboratory sciences.
10. Emerging developments in industrial laboratory science.

Teaching and Learning Strategy

Students will get a solid grounding in the ever-evolving area of Industrial Laboratory Science. The module will enhance understanding of the life sciences industry building foundation knowledge to underpin further study. A learning platform can be used as a repository of educational resources and as a means of assessment (e.g., uploading assessments and journals).

Assessment Strategy

The module will be assessed entirely by continuous assessment. This will comprise of multiple choice/short answer question assessments and written assignments throughout the semester.

Repeat Assessment Strategies

The repeat assessment will require resubmission of continuous assessment work.

Additional Facilities

| | | | | |
|---|--------------|----------------|--------------------------|--------------------------|
| Indicative Coursework and Continuous Assessment: | | 100 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |

| | | | | |
|------------|--------------------------------|------|---------|---------|
| Assessment | MCQ and Short Answer Questions | 60 % | OnGoing | 1,2,3,4 |
| Assessment | Written Assessment | 20 % | OnGoing | 4 |
| Assessment | Written Assessment | 20 % | OnGoing | 1,2,3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|----------------------|------------------------|-----------------|--------------|------------------|
| Lecture | Lecture | Not Specified | 2 | Weekly |
| Independent Learning | Self Directed Learning | Not Specified | 5 | Weekly |

Recommended Reading Book List

Lr, P., Hargreaves, J., (2022). *Basic Bioscience Laboratory Techniques*. John Wiley & Sons.
ISBN 9781119663355 ISBN-13 1119663350

Gault, A., McClenaghan, H., (2009). *Understanding Bioanalytical Chemistry*. Wiley.
ISBN 0470029072 ISBN-13 9780470029077

Literary Resources**Journal Resources**

Students will be referred to journals where appropriate.

Online Resources

Relevant online and other resources as directed.

Other Resources

Relevant online and other resources as directed.

Programme Membership



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an Atlantaigh

Atlantic
Technological
University

GMP06003 2019 CALIBRATION SCIENCE

Mandatory Delivered in Stage 1 Semester 2

| | | | |
|----------------------|---------------------|-----------------------|--------------------|
| Full Title | CALIBRATION SCIENCE | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Stage - (30 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eileen Armstrong | | |
| Co Authors | Aodhmar Cadogan | | |

Module Description

The module introduces learners to the basic requirements of Calibration in Industry. The module links Calibration requirements in the Pharmaceutical industry to Good Manufacturing Practice and explains why Calibration is a basic GMP requirement.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe the importance of calibration in industry today and explain how calibration is related to GMP
2. Describe some basic calibration procedures.
3. Describe the important elements of a calibration system.
4. Explain the role of Regulatory bodies in relation to Calibration.

Indicative Syllabus

Calibration systems:

What calibration systems are and why they are necessary. How to determine the frequency of calibration of a laboratory instrument. What happens when an instrument fails calibration. What are accuracy, precision and traceability and how these relate to calibration. Introduction to the concept of Test Accuracy Ratio.

Regulatory requirements:

What are the regulatory requirements in relation to Calibration. Who the NSAI and INAB are and their role in relation to Calibration.

Standards:

The ISO standard that relates to Calibration requirements. What are Standards Laboratories. What is Accreditation and how laboratories gain accreditation.

GMP and Calibration Documentation:

How Calibration is related to GMP. What the role of various departments are in relation to Calibration. What the documentation requirements are for the Calibration system.

Instrument Calibration:

A basic introduction to calibration of commonly used laboratory instruments.

Teaching and Learning Strategy

This module is delivered online via a variety of virtual learning platforms and software. The module will be taught using lectures supported by other electronic resources for use during independent self-directed learning and directed learning.

Assessment Strategy

Continuous Assessment and Final Examination

Repeat Assessment Strategies

As per ATU Sligo procedures

| Additional Facilities | | | | |
|--|-----------------------|-----------------|--------------------------|--------------------------|
| . | | | | |
| Indicative Coursework and Continuous Assessment: | | | 40 % | |
| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
| Assessment | Continuous Assessment | 20 % | Week 5 | 1,2,3,4 |
| Assessment | Continuous Assessment | 20 % | Week 10 | 1,2,3,4 |
| End of Semester / Year Formal Exam: | | | 60 % | |
| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
| Assessment | Final Exam | 60 % | End of Term | 1,2,3 |
| Part Time Delivery Mode: | | | | |
| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
| Lecture | Lecture | Not Specified | 2 | Weekly |
| Literary Resources | | | | |
| Any book resources will be relayed by lecturer on yearly basis. | | | | |
| Journal Resources | | | | |
| None | | | | |
| Online Resources | | | | |
| National Standards Authority of Ireland (2019) available: https://www.nsai.ie/ [accessed: 21 March 2019] | | | | |
| Irish National Accreditation Board (2019) available: https://www.inab.ie/ [accessed: 21 March 2019] | | | | |
| Health Products Regulatory Authority (HPRA)available: https://www.hpra.ie/ [accessed: 21 March 2019] | | | | |
| European Commisision (2019) EudraLex - Volume 4 - Good Manufacturing Practice (GMP) guidelines, available: https://ec.europa.eu/health/documents/eudralex/vol-4_en [accessed: 21 March 2019] | | | | |
| Other Resources | | | | |
| Provided by lecturer on a yearly basis | | | | |
| Programme Membership | | | | |
| | | | | |

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Laboratory Science Skills | | |
| Status | Approved by Academic Council | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Ioannis Manolakis | | |
| Co Authors | Margaret Doherty, Neville McClenaghan, Sarah Best | | |

Module Description

This module aims to introduce fundamental aspects of bioanalysis and provide students with key laboratory skills and techniques required to work in a regulated industrial laboratory. The module will provide a hands-on, practical experience in experimentation, interpretation and reporting methods used in an industrial laboratory setting.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Demonstrate accuracy and precision in pipetting, solution preparation and perform measurements.
2. Experimentally perform, communicate and interpret laboratory determinations.
3. Effective analysis, interpretation and presentation of scientific data including accurate professional communication using written, visual and numeral forms.
4. Carry out laboratory work in a professional manner that meets best practice standards and health and safety requirements.

Indicative Syllabus

Data analysis, interpretation and presentation; Volumetric analysis; Determination of liquid and solid densities; Preparation of standard solution and concentration determinations; Acid/Base titrations, Potentiometric titration and determining pH; Glass pipetting and dilutions; Isoelectric point determination and evaluation of pH range over which a buffer solution is efficient.

Teaching and Learning Strategy

Teaching and learning will be achieved via a blend of lecture material with laboratory-based practical coursework (1-2-day practical workshop in ATU Sligo) and relevant experiment simulations, self-directed reading of the subject matter, laboratory report writing, assignment, discussion and assessment.

Assessment Strategy

Assessment will be achieved through laboratory practical participation, report writing, assignment and quiz (multiple choice questions/short answer questions). As the practical workshops are must pass assessed elements, all students must attend these sessions and complete the associated course work submission.

Repeat Assessment Strategies

Repeat Assessment will be achieved through laboratory practical participation, report writing, assignment and quiz (multiple choice questions/short answer questions).

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 100 % | | |
|--|--------------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | MCQ and Short Answer Questions | 20 % | End of Semester | 3 |
| Assignment | Written Assignment | 20 % | Week 4 | 2,3,4 |
| Lab Report | Practical Evaluation | 60 % | End of Semester | 1,2,3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|---------------------------------|--------------------|--------------|-------------------|
| Lecture | Online Lecture | Online | 1 | Weekly |
| Practical / Laboratory | Assessed Laboratory Workshop(s) | Science Laboratory | 8 | Once Per Semester |
| Independent Learning | Self Directed Learning | Not Specified | 4 | Weekly |

Required Reading Book List

Crowe, J., Bradshaw, T., (2021). *Chemistry for the Biosciences*. Oxford University Press.
ISBN 9780198791041 ISBN-13 0198791046

Lewis, R., Evans, W., (2018). *Chemistry*. Red Globe Press.
ISBN 9781137610355 ISBN-13 1137610352

Recommended Reading Book List

Boyer, F., (2005). *Concepts in Biochemistry*. Wiley.
ISBN 0471661791 ISBN-13 9780471661795

Windelspecht, M., Mader, S., (2015). *Mader, Biology, AP Edition*. McGraw-Hill Education.
ISBN 0076739937 ISBN-13 9780076739936

Voet, D., Voet, G., Pratt, W., (2016). *Fundamentals of Biochemistry*. John Wiley & Sons.
ISBN 9781118918401 ISBN-13 1118918401

Masterton, L., Hurley, N., Neth, E., (2011). *Chemistry: Principles and Reactions*. Cengage Learning.
ISBN 1111427100 ISBN-13 9781111427108

Campbell, A., Reece, B., Urry, A., (2011). *Biology*. Pearson Education.
ISBN 0321739752 ISBN-13 9780321739759

Abali, E., Cline, D., Franklin, S., Dr, P., (2021). *Lippincott Illustrated Reviews: Biochemistry*.
ISBN 1975155114 ISBN-13 9781975155117

Literary Resources

Journal Resources

Students will be referred to journals where appropriate.

Online Resources

- Pubmed: <http://www.ncbi.nlm.nih.gov/pubmed>
- Science Direct: <http://www.sciencedirect.com/>
- Royal Society of Chemistry: www.rsc.org
- RSC Education: <https://edu.rsc.org>

Other Resources

Programme Membership



Stage 2 Modules

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | Analytical Techniques | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Carmel Moran | | |

Module Description

The course introduces the student to the basic elements of chemical analysis from sample preparation to the collection and statistical evaluation of analytical data. The course deals with aspects of volumetric analysis including the application of primary and secondary standards. The course also provides both a theoretical and practical introduction to several instrumental analysis techniques including infrared spectroscopy, ultraviolet -visible spectroscopy, atomic absorption, liquid and gas chromatography.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Define basic analytical theory and standard/sample preparation.
2. Demonstrate an understanding of the underlying concepts and principles of a range of instrumental and classical methods of analysis.
3. Demonstrate competence in the practical application of selected instrumental and classical methods of analysis.
4. Calculate chemical compositions from raw analytical data in a variety of units and evaluate the reliability of analytical data using simple statistical and quality control techniques.
5. Communicate and report the findings of experimental analysis in an individual and /or group format taking into consideration good laboratory practice.

Indicative Syllabus

Define basic analytical theory and standard/sample preparation

Basic analytical GLP. Overview of chemicals, reagents and apparatus used in analytical chemistry.

Demonstrate an understanding of the underlying concepts and principles of a range of instrumental and classical methods of analysis.

Spectroscopy: Atomic absorption, Flame photometry, Ultraviolet - Visible Spectroscopy, Infra-red.

Chromatography: Mode of Separation, High Performance Liquid chromatography, Gas Chromatography.

Standards: Primary and secondary standards. External, Internal and Standard Additions.

Demonstrate competence in the practical application of selected instrumental and classical methods of analysis.

Instrument calibration, qualitative analysis, quantitation using single and multiple external standards, internal standard and standard addition techniques.

The laboratory course is integrated closely with the theory component. The experiments represent a subset of common instrumental (infrared, uv-visible, gas chromatography, atomic absorption, HPLC) and non-instrumental qualitative and quantitative chemical analysis techniques. Emphasis throughout is on data quality and developing a high standard of personal analytical competence and confidence.

Calculate chemical compositions from raw analytical data in a variety of units and evaluate the reliability of analytical data using simple statistical and quality control techniques.

Volumetric and gravimetric calculations.

Relationship between units of concentration (Molarity, molality, % wt/wt, % wt/vol, % vol/vol, ppm, ppb).

Statistical evaluation of the data in order to ascertain accuracy and precision of laboratory findings.

Communicate and report the findings of experimental analysis in an individual and /or group format taking into consideration good laboratory practice.

Data recording, effective use of laboratory notebook, management and presentation of analytical information. Report writing demonstrating an understanding of the findings and an ability to critically evaluate the data obtained.

Teaching and Learning Strategy

This module will be delivered full-time. This will include lectures and laboratory practicals augmented by independent learning and directed learning. This approach is expected to address student learning needs. Moodle will be used as a repository of educational resources and as a means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

This module is 65% Continuous Assessment and 35% Final Exam.

Continuous assessment will provide the student with the opportunity to demonstrate the learning outcomes and monitor the student's progress. The continuous assessment is broken down into practical assessment (50%) and theory continuous assessment (15%).

Laboratory skills and report writing ability (50%) are assessed as part of the practical work performed during the module. A **minimum attendance of 75%** is required in order to meet the learning outcomes of the practical component of this module. Failure to meet this requirement may result in repeat attending the module.

Theory continuous assessment (15%) is broken down into an assignment (7%) mid-semester and a MCQ quiz (8%) at the end of the semester.

The final exam is designed to test the ability of the student to retain and interpret the information obtained during the course. The student must reach an assigned gate (mark) in the final exam and achieve 40% overall to pass the subject.

Repeat Assessment Strategies

Repeat Continuous Assessment and/or Final Exam

Additional Facilities

Science Laboratory

Flat classroom

Final Examination Centres

| Indicative Coursework and Continuous Assessment: | | 65 % | | |
|---|--|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Written Report/Essay | Laboratory Reports, Quality of Analytical results, Laboratory Technique, Pre-laboratory exercises, Practical Exam. | 50 % | OnGoing | 2,3,4,5 |
| Assignment | Continuous Assessment | 7 % | Week 6 | 4 |
| Multiple Choice/Short Answer Test | Continuous Assessment | 8 % | Week 13 | 1,2 |

| End of Semester / Year Formal Exam: | | 35 % | | |
|--|----------------------|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | End of Semester Exam | 35 % | End of Term | 1,2,3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 2 | Weekly |

Required Reading Book List

Harris, C., (2015). *Quantitative Chemical Analysis*. WH Freeman.
ISBN 131915414X ISBN-13 9781319154141

Douglas, D., (2013). *Fundamentals of Analytical Chemistry*. Cengage Learning.
ISBN 0495558281 ISBN-13 9780495558286

Ando, J., *Ultraviolet and visible spectroscopy*. John Wiley & Sons Inc.
ISBN UOM:39015040564869

Literary Resources

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Journal Resources

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Online Resources

<https://www.sigmaaldrich.com/technical-documents/articles/biology/ir-spectrum-table.html>

https://chem.libretexts.org/Ancillary_Materials/Reference/Reference_Tables/Spectroscopic_Parameters/Infrared_Spectroscopy_Absorption_Table

https://www.cpp.edu/~psbeauchamp/pdf/spec_ir_nmr_spectra_tables.pdf

Other Resources

None

Programme Membership

SG_SAGRI_B07 201900 Bachelor of Science in Agri-Food Science
SG_SSUST_C06 201900 Higher Certificate in Science in Sustainable Food Production
SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SAGRI_H08 202000 Bachelor of Science (Honours) in Agri-Food Science
SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science
SG_SHUMA_H08 202200 Bachelor of Science (Honours) in Human Nutrition
SG_SHUMA_B07 202200 Bachelor of Science in Human Nutrition
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | BIOCHEMISTRY 1 | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Dr. Oliver Joyce | | |

Module Description

The module aims to illustrate to learners the structure and function of macromolecules of the cell and how they integrate into cellular function.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain the function of macromolecules in the cell.
2. Describe mammalian cellular energetics.
3. Describe the action of enzymes and discuss factors that affect enzyme kinetics.
4. Outline the organisation of nucleic acids in the cell.
5. Illustrate the cell cycle.
6. Relate some applications of molecular biology.
7. Perform and report on, biochemical laboratory experiments and communicate information accurately and effectively using written, visual and numeral forms.

Indicative Syllabus

Biomembranes

Amino acids, protein folding, protein sequencing and protein purification/isolation.

Enzymology

The structure and function of proteins. Enzyme kinetics

Mammalian Cellular Energetics

Glycolysis, Krebs Cycle, Oxidative Phosphorylation and fermentation.

The Organisation of Nucleic acids in the cell

DNA structure, histones, nucleosomes,

Cell Cycle & Cell growth control

Cell cycle control in mammalian cells, checkpoints in cell cycle regulation, onset of cancer.

Laboratory Practicals and Student Centred Learning

The module will include laboratory practicals which will supplement the lecture based learning.

Teaching and Learning Strategy

The Biochemistry One module will be delivered full time and will include lectures, laboratory practicals and tutorials. Moodle will be used as a repository of educational resources and as a means of assessment where appropriate.

Assessment Strategy

The Biochemistry One module is 50% Practical and 50% Theory.

Laboratory skills and report-writing ability are assessed as part of the practical work performed during the module (50%). There will be two MCQs (15%) and there will be a Final Exam (35%)

The student must reach an assigned gate of 30% in the final exam and achieve 40% overall to pass the subject.

| Repeat Assessment Strategies | | | | |
|---|--------------------------------------|--------------------|--------------------------|--------------------------|
| Repeat Continuous Assessment and/or Final Exam | | | | |
| Additional Facilities | | | | |
| . | | | | |
| Indicative Coursework and Continuous Assessment: | | | 65 % | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Multiple choice questions in lecture | - % | OnGoing | 1,2,3,4,5,6 |
| UNKNOWN | Practical skills evaluation | 50 % | OnGoing | 7 |
| UNKNOWN | Multiple choice questions | 15 % | Week 5 | 1,2,3,4,5,6 |
| End of Semester / Year Formal Exam: | | | 35 % | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Final Exam | 35 % | End of Semester | 1,2,3,4,5,6 |
| Full Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 7 | Weekly |
| Tutorial | Tutorial | Lecture Theatre | 1 | Weekly |
| Literary Resources | | | | |
| Biology Mader current version | | | | |
| Molecular Cell Biology Lodish et al current version | | | | |
| Fundamentals of Biochemistry, Voet, Voet & Pratt current version | | | | |
| Journal Resources | | | | |
| N/A | | | | |
| Online Resources | | | | |
| vle.itsligo.ie | | | | |
| https://www.ncbi.nlm.nih.gov/pubmed/ | | | | |
| http://pubcrawler.gen.tcd.ie | | | | |
| Other Resources | | | | |
| <i>Pubmed, Pubcrawler, Science Direct</i> | | | | |
| Programme Membership | | | | |
| SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science | | | | |
| SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology | | | | |
| SG_SFORE_H08 201900 Bachelor of Science (Honours) in Forensic Investigation and Analysis | | | | |
| SG_SFORE_B07 201900 Bachelor of Science in Science in Forensic Investigation and Analysis | | | | |
| SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science | | | | |
| SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science | | | | |

| | | | |
|----------------------|----------------------------------|-----------------------|-----------------------|
| Full Title | BIOMATERIALS AND MEDICAL DEVICES | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Richard Sherlock | | |

Module Description

This is an introductory module covering concepts in Materials Science and Materials Engineering that may be of relevance to biomedical science and medical biotechnology. The content is framed in the context of the selection and suitability of materials used in biomedicine and in medical devices.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Define basic concepts and explain general principles of materials science.
2. Describe, discuss and use examples of how the structure of materials influences the properties and performance of materials and apply knowledge of basic material science to identify material properties that are critical for metallic, polymer and ceramic biomaterials, or their combination.
3. Explain the operation of a range of instruments in materials testing and examination.
4. Report the performance of a materials science experiment and/or test in a prescribed manner, presenting results, processing and interpreting data, and deducing informed conclusions.
5. Research, analyse, interpret and report information relevant to function and construction of biomedical devices and describe the relevance of the choice of biomaterial for given applications.

Indicative Syllabus

Basic Science of Materials

Atomic Structure, Elements and the Periodic Table. Atomic Bonding and Molecules. Compounds, Mixtures. Solids, Liquids and Gases. Avogadro's Number and the mole concept. Crystalline and Amorphous Structures. Crystals, Allotropy, Grain structure. Metallic Bond. Defects in metals. Dislocations : edge and screw type. Dislocation motion and multiplication.

Introduction to Materials and their Properties

Overview of properties of metals, ceramics, polymers and composites. Factors affecting material selection. Mechanical properties of materials. Physical properties of materials. Surface properties.

Material Behaviour

Elastic and Plastic Deformation. Heat treatment basics. Strengthening mechanisms. Fracture and failure in materials.

Materials testing

Tensile test. Tensile test data. Proof stress. Effect of grain size and structure on tensile testing. Tensile testing of polymers. Impact testing. Interpretation of impact test data. The effect of processing on hardness. Hardness testing.

Biomaterials in action

Definition of "Biomaterial". Composition, structure, properties and manufacture of biomaterials used for medical applications. Description of medical grade alloys. Description of standard polymers used for biomedical applications.

Medical Devices

Construction and functions of medical devices. Selection of materials for medical devices based on material properties and cost.

Teaching and Learning Strategy

This module will be delivered full-time in a face-to-face classroom environment. Theory will be taught in a lecture setting 2 hrs per week. Laboratory teaching will take place every week in a 2 hour session. Learners will augment face-to-face class time with independent learning.

Assessment Strategy

A written reports in the form of a short essay will be assigned during the module to assess the learner's progress in understanding the fundamental concepts of materials science and interpreting these concepts in the context of biomedical applications. The assignments will normally be scheduled before the mid point of the

semester to encourage early and consistent engagement with the module, to monitor progress and provide feedback.

A group presentation exercise focussing on medical devices will be scheduled towards the end of the module. This is to encourage the learners to demonstrate a knowledge of materials science in the context of medical device applications. The exercise will also promote peer assisted learning of the basics of a wide range of medical devices and will enable learners to demonstrate team-working and presentation skills.

Towards the end of the semester learners will take a short summative quiz. The purpose of the quiz is to encourage learners to engage with the totality of the course material well in advance of the terminal exam and to afford them the opportunity to assess their integrated understanding.

Laboratory skills and report-writing ability will be assessed weekly as part of the practical work performed during the module.

An end of semester terminal written exam will be used to assess the learner's integrated understanding of the module.

Learners must reach an assigned gate of 30% of the available marks in the end of semester terminal exam and achieve at least 40% overall to pass the module.

Learners must attend at least 75% of the available practical sessions to pass the module.

Repeat Assessment Strategies

Repeat assessments will be of the same kind as any failed elements and can include any required combination of repeat final exam, repeat practical exam, and/or repeat quiz. Under certain circumstances the learner may be required to repeat attend the module.

| Indicative Coursework and Continuous Assessment: | | 60 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Written Report Short essay on materials topic | 5 % | Week 4 | 1,2,5 |
| UNKNOWN | Presentation Group presentation on Medical Device | 20 % | Week 11 | 1,5 |
| Assessment | Short quiz | 5 % | Week 12 | 1,2,3 |
| UNKNOWN | Practical Evaluation Laboratory report | 30 % | OnGoing | 4 |

| End of Semester / Year Formal Exam: | | 40 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Final Exam | 40 % | End of Term | 1,2,3 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|-------|-----------|
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Recommended Reading Book List

Hoffman, S., (2012). *Biomaterials Science: An Introduction to Materials in Medicine*. 3rd Edition. Academic Press.

Qizhi, G., (2014). *Biomaterials*. CRC Press.
ISBN 9781482227697 ISBN-13 148222769X

Appleford, R., (2013). *Introduction to Biomaterials*. Cambridge University Press.
ISBN 9780521116909 ISBN-13 0521116902

Lakes, R S., (2007). *Biomaterials*. Springer.
ISBN 0387378790 ISBN-13 9780387378794

Davis, R., (2003). *Handbook of Materials for Medical Devices*. Asm International.
ISBN UOM:39015057642228

Literary Resources

See Booklist

Journal Resources

None

Online Resources

<https://steeluniversity.org/>

http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/tensile_testing/index.htm

<https://www.mtu.edu/materials/k12/experiments/tensile/>

<https://www.gordonengland.co.uk/>

Other Resources

None

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|------------------------------------|-----------------------|-----------------------|
| Full Title | MICROBIOLOGY | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Dr. John Barrett Phd. | | |
| Co Authors | Angela McMorrow, John Barrett Phd. | | |

Module Description

The aim of this module is to introduce the student to both the theoretical and practical aspects of basic microbiological techniques required to safely handle, investigate and manipulate micro-organisms in laboratory setting. Students will be provided with the opportunity to acquire knowledge of the subject matter through a variety of lecturer led activities and self-directed study. Such activities will include traditional and interactive lectures, problem solving and revision tutorials and laboratory practical classes. Theoretical and practical problems will be employed to assist students in the development of their analytical and problem solving capabilities.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|-----|---|
| 1. | Understand that microorganisms comprise a diverse range of organisms that includes bacteria, fungi, protozoans, algae, viruses and sub-viral particles. |
| 2. | Understand microbial structural diversity and classification. |
| 3. | Be aware of microbial physiological diversity which is reflected in a range of microbial activities in nature, in their importance in biotechnology and in health and disease. Understand the theoretical and practical principles underpinning a diverse range of methodologies aimed at controlling microbial growth. |
| 4. | Be capable of manipulating and interpreting numerical data relating to microbiological analysis. |
| 5. | Understand the importance of, and work in compliance with, health and safety policies and good laboratory practice as it pertains to microbiology laboratories. |
| 6. | Demonstrate an awareness of key principles of Microbiology and be able to explain major microbiological concepts by demonstrating a capacity for critical scientific analysis of relevant issues. |
| 7. | Be able to design and execute experiments, systematically collect and analyze data, identify sources of error, and interpret the results and reach logical conclusions. They should also have a basic understanding of safety issues. |
| 8. | Operate basic laboratory instruments used in microbiology practical experimentation. |
| 9. | Apply the scientific method by stating a question; researching the topic; determining appropriate tests; performing tests; collecting, analyzing, and presenting data; and finally proposing new questions about the topic. |
| 10. | Be able to (1) differentiate between fact and opinion, (2) recognize and evaluate author bias and rhetoric, (3) develop inferential skills, (4) recognize logical fallacies and faulty reasoning, and (5) make decisions and judgments by drawing logical conclusions using sound quantitative and statistically-based reasoning. |
| 11. | Understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills. |

Indicative Syllabus

Theory:

- 1. History of microbiology.
- 2. Microscopy.
- 3. The structure of the bacterial cell.
- 4. Aseptic technique.
- 5. Microbial classification.
- 6. Chemical factors affecting microbial growth.
- 7. Physical factors affecting microbial growth.
- 8. Controlling microbial growth.

- 9. Culturing microbes.

Indicative Practical:

- 1. Aseptic techniques.
- 2. Staining of microbial cells - Gram stain, spore stain.
- 3. Microbial motility tests - direct microscopic observation and motility agar technique.
- 4. Culture techniques- aerobic and aerobic culture.
- 5. Enumerating microbes - pour plate, spread plate.
- 6. Controlling microbial growth- disinfectant efficacy tests (MIC), antibiotic susceptibility tests.

Teaching and Learning Strategy

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Assessment Strategy

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Repeat Assessment Strategies

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Additional Facilities

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| Indicative Coursework and Continuous Assessment: | | 65 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Mid term assessment. | 15 % | Week 7 | 1,2,3 |
| UNKNOWN | Health and safety compliance - safe handling of microbes, safety glasses compliance | 5 % | OnGoing | 5 |
| UNKNOWN | Post practical assessments | 15 % | OnGoing | 4,10 |
| UNKNOWN | Practical skills assessment. | 10 % | OnGoing | 8 |
| UNKNOWN | Group laboratory based mini project on identification of an unknown microbe | 15 % | OnGoing | 7,9,11 |
| UNKNOWN | Report preparation and submission | 5 % | OnGoing | 4 |

| End of Semester / Year Formal Exam: | | 35 % | | |
|-------------------------------------|--------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Final theory examination | 35 % | End of Term | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-----------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Work | Science Laboratory | 2 | Weekly |
| Independent Learning | Self study | UNKNOWN | 4 | Weekly |

Literary Resources

Brock Biology of Microorganisms -

[Michael T. Madigan](#), [Kelly S. Bender](#) and Daniel H. Buckley

Edition: 15TH Copyright: 2018 Publisher: Pearson, Published: 2018

Text Only - 15th edition. ISBN13: 9780134261928

Microbiology: Laboratory Theory and Application, - 3rd edition

[Michael J. Leboffe](#) and [Burton E. Pierce](#)

Edition: 3RD 16 Copyright: 2016 Publisher: Morton Publishing Co.

Published: 2016. ISBN13: 9781617314773

Microbiology - 2nd edition

[Anthony Strelkauskas](#)

Edition: 2ND 16 Copyright: 2016 Publisher: Garland Publishing

Published: 2016. ISBN13: 9780815345138

Medical Microbiology - 8th Edition

[PhD \(Author\)](#), [Michael A. Pfaller MD \(Author\)](#)

0323299565

[Patrick R. Murray PhD \(Author\)](#), [Ken S. Rosenthal](#)

Published: 2019. ISBN-13: 978-

Medical Microbiology - 8th Edition

Elsevier

Patrick Murray Ken Rosenthal Michael Pfaller.

Published Date: 28th October 2015. ISBN: 9780323299565

Other Resources

[Microbiology Webbed Out-http://www.bact.wisc.edu/MicrotextBook](http://www.bact.wisc.edu/MicrotextBook)

[Pats Medical Microbiology Sites-http://www.ualberta.ca/~pletendr/micro.html](http://www.ualberta.ca/~pletendr/micro.html)

Federation of European Microbiology Societies: <http://www.fems-microbiology.org/>

Society for General Microbiology: <http://www.socgenmicrobiol.org.uk/>

FDA Bacteriological **Analytical** Manual (BAM) <http://vm.cfsan/>

Journals:

Annual Reviews in Microbiology / Microbiology and Molecular Biology Reviews / Nature Reviews in Microbiology / Trends in Microbiology

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science

SG_SPHAR_B07 201900 Bachelor of Science in Pharmaceutical Science with Drug Development

SG_SPHAR_H08 201900 Bachelor of Science (Honours) in Pharmaceutical Science with Drug Development

SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology

SG_SFORE_H08 201900 Bachelor of Science (Honours) in Forensic Investigation and Analysis

SG_SFORE_B07 201900 Bachelor of Science in Science in Forensic Investigation and Analysis

SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science

SG_SPHAR_C06 202100 Higher Certificate in Science in Pharmaceutical Science

SG_SHUMA_H08 202200 Bachelor of Science (Honours) in Human Nutrition

SG_SHUMA_B07 202200 Bachelor of Science in Human Nutrition

SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science



SAFE06023 2019
ENVIRONMENT HEALTH AND SAFETY

Elective Delivered in Stage 2 Semester 3

| | | | |
|----------------------|-------------------------------|-----------------------|-----------------------|
| Full Title | ENVIRONMENT HEALTH AND SAFETY | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Mary Hannon | | |
| Co Authors | Edel Costello | | |

Module Description

This module will give students a foundation in Environmental Health and Safety enabling them to apply these fundamentals to the area of pharmaceutical science.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Identify hazards in the workplace and apply appropriate control measures with special reference to the needs of the pharmaceutical sector.
2. Outline the parameters used for Environmental Health and Safety monitoring in Ireland
3. Examine the links between environmental and occupational safety and health issues in the workplace.
4. Identify and analyse Occupational Safety and Health and Environmental legislation with reference to its impact on the Pharmaceutical sector.
5. Communicate the need for effective management of Environmental, Health and Safety issues in the workplace.

Indicative Syllabus

Environmental monitoring and analysis; atmosphere, water, wastewater, waste etc.
 IPPC licencing.
 Hazard identification and risk assessment
 Fire, electricity, emergency planning and hazards associated with building activities relevant to the pharmaceutical sector
 Noise, dust, vibration and associated occupational hygiene issues.
 Occupational diseases, health promotion and psychosocial hazards.
 Manual handling, ergonomics.
 Hazardous materials classification, confined spaces, lock-out tag-out etc.
 Relevant EHS legislation.

Teaching and Learning Strategy

This module will be delivered full time and will include lectures and practical demonstrations augmented by collaborative work, independent and directed learning.

Assessment Strategy

Students will be assessed individually and as groups through a variety of written assignments and presentation work. Short answer questions will summarise the individuals learning at the end of the semester.

Repeat Assessment Strategies

Continuous Assessment and/or final exam

Additional Facilities

Flat Classroom

Indicative Coursework and Continuous Assessment: 100 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|---------------|--|----------------|--------------------------|--------------------------|
| UNKNOWN | Class discussion and feedback. | - % | OnGoing | 1,3,4,5 |
| Assignment | Individual Project Hazard Identification and Risk Assessment project based on a prescribed work environment | 20 % | OnGoing | 1,4,5 |
| Group Project | Group project integrating the principles of EHS into a chemical/pharmaceutical/ prescribed workplace setting | 40 % | OnGoing | 1,2,3,4,5 |
| Assessment | Short Answer Questions exam of questions covering the entire module content | 40 % | OnGoing | 1,2,3,4,5 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|----------------------|--------------------|-----------------|--------------|------------------|
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Required Reading Book List

Boyle, T., (2019). *Health and Safety: Risk Management*. Routledge.
ISBN 9780429790775 ISBN-13 0429790775

Stranks, J., (2016). *Health and Safety at Work*.
ISBN 0749478179 ISBN-13 9780749478179

Literary Resources

Mooney A.M. (2003) Environmental Law Cavenish

Corbitt R.A. (1998) 2nd Ed Standard Handbook of Environmental Engineering McGraw-Hill

EPA (2006) Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision EPA

EPA BAT Guidance Notes for various sectors EPA

Ridley J. & Channing J. (2004) 6th ed Safety At Work Butterworth Heinemann

Stranks J. (2000) 5th ed Handbook of Health and Safety Practice Pearson Education

Ridley J. (2004) 3rd ed Health and Safety in Brief Elsevier Butterworth Heinemann

Stranks J. (1995) Occupational Health and Hygiene Pitman Publishing

Journal Resources

Health and Safety Review

Online Resources

www.hsa.ie

www.epa.ie

www.hse.gov.uk

Other Resources

Access to Moodle

Programme Membership

SG_SPHAR_B07 201900 Bachelor of Science in Pharmaceutical Science with Drug Development

SG_SPHAR_H08 201900 Bachelor of Science (Honours) in Pharmaceutical Science with Drug Development

SG_SPHAR_C06 202100 Higher Certificate in Science in Pharmaceutical Science



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BIO06006 2019 MEDICAL IMMUNOLOGY

Elective Delivered in Stage 2 Semester 4

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | MEDICAL IMMUNOLOGY | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Dr. John Barrett Phd. | | |

Module Description

The course introduces students to the immune system as an innate and adaptive defence system that recognizes invading pathogenic organisms and mounts a response to eliminate or neutralize foreign infectious agents. Students will be introduced to the molecules, the cells and organs, and the processes involved in host defence against infection. An overview of basic principles, concepts, and techniques used to assess immune status will be presented.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Be familiar with the human immune system, including both cell-mediated and humoral responses.
2. Understand the distinction between the specific and non-specific response and how they function together.
3. Understand the structure, function and types of antibodies.
4. Be familiar with the different types of T cells, their response to antigens and relationship to B cells.
5. Understand the causes and consequences of immune system dysfunction (including Acquired Immune Deficiency Syndrome).
6. Be aware of current methodologies in the area of immunotherapy immunoassay and immunodiagnosis.

Indicative Syllabus

Theory:

1. Introduction to the vertebrate immune system.
2. Innate and acquired immune response.
3. Antibodies: structure, types, functions.
4. Cytokines, lymphokines and chemokines.
5. The inflammatory response.
6. Immunoassay, immunodiagnosis & immunotherapy.
7. Immunodeficiencies, autoimmunity and hypersensitivity.

Teaching and Learning Strategy

Assessment Strategy

Repeat Assessment Strategies

| Indicative Coursework and Continuous Assessment: | | 0 % | | |
|--|--------------------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Continuous assessment of course work | 30 % | OnGoing | 1,2 |
| UNKNOWN | Continuous assessment of course work | 30 % | OnGoing | 3,4 |
| UNKNOWN | Continuous assessment of course work | 40 % | OnGoing | 5,6 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------|-------------|----------|-------|-----------|
|------|-------------|----------|-------|-----------|

| | | | | |
|----------------------|------------|------------------|---|--------|
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Literary Resources

Roitt's essential immunology

Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt. Date 2017.

Publisher Wiley Blackwell 13th edition.

ISBN-13 9781118415771.

How the immune system works

Lauren Sompayrac. Date 2016.

Publisher Wiley Blackwell Chichester, West Sussex

Fifth edition.

ISBN-13 9781118997772.

Basic Immunology, 5th Edition

Functions and Disorders of the Immune System

Authors: [Abul K. Abbas](#) & [Andrew H. H. Lichtman](#) & [Shiv Pillai](#)

Date of Publication: 2015.

Other Resources

Journals:

Annual Reviews in Microbiology

Microbiology and Molecular Biology Reviews

Nature Reviews in Microbiology

Trends in Microbiology

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science

SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology

SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science

SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Molecular Biology | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Mary Heneghan | | |

Module Description

The aim of this module is to provide students with an understanding of the basic principles underpinning molecular biology. The module will introduce students to DNA and RNA structure, DNA replication, transcription and translation. Students will explore practical applications of molecular biology, some of which will include Agarose Gel Electrophoresis, Nucleic Acid Extraction, PCR, Cloning and Restriction Digestion. This module will also introduce students to the analysis and manipulation of nucleic acids and plasmid DNA.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Compare and contrast nucleic acid structures and describe some techniques used in their analysis.
2. Describe the mechanism of DNA replication.
3. Elucidate the processes involved in gene expression and regulation.
4. Summarise the main steps in the Polymerase Chain Reaction.
5. Appreciate the complexity of gene cloning and depict the key steps in the process.
6. Interpret and analyse bioinformatic data.
7. Perform key molecular biology techniques in a laboratory setting.
8. Analyse, collate and report on experimental data generated in practical sessions.

Indicative Syllabus

Compare and contrast nucleic acid structures and describe some techniques used in their analysis.

- Nitrogenous bases, pentose sugar, phosphodiester bond
- Chargaff's rules
- Double helix, hairpin loops
- Chain polarity
- mRNA, tRNA, rRNA, siRNA, snRNA
- Techniques may include: Agarose gel electrophoresis, Purification and quantification, Restriction digestion, Sequencing

Describe the mechanism of DNA replication.

- Semiconservative
- Leading and lagging strands
- Enzymes involved in replication
- Energy for replication

Elucidate the processes involved in gene expression and regulation.

- Transcription
- Posttranscriptional modifications
- Control of transcription (Promoters, Transcription Factors, Operons)
- Genetic code
- Translation
- Protein structure

Summarise the main steps in the Polymerase Chain Reaction.

- Denaturation
- Annealing
- Extension
- Primer design and annealing temperature calculation

Appreciate the complexity of gene cloning and depict the key steps in the process.

- Plasmids
- Ligation
- Transformation
- Selectable markers
- Directional cloning

Interpret and analyse bioinformatic data.

- DNA sequencing
- 6 frame translation
- Restriction digestion analysis
- Mutations in nucleotide sequence
- Plasmid mapping

Perform key molecular biology techniques in a laboratory setting. Some of these may include:

- Agarose gel electrophoresis
- DNA extraction
- Quantification of DNA
- PCR
- Cloning
- Restriction digestion

Analyse, collate and report on experimental data generated in practical sessions, some of which may include:

- Agarose gel electrophoresis
- DNA extraction
- Quantification of DNA
- PCR
- Cloning
- Restriction digestion

Teaching and Learning Strategy

This module will be delivered full-time. Lecture delivery will be the primary mode of dissemination for module theory while practical applications will be explored during laboratory sessions. A 'spiral curriculum' approach will be employed to develop the student's competencies in molecular biology. This will enable the student to revisit a topic, several times throughout the module. The complexity of the topic will increase with each revisit; and this new learning will be put in context with the old information. Critical and reflective thinking will be developed through the analysis of laboratory work. Active learning will be fostered through inquiry-based learning activities designed to promote the students research and evaluation skills. Visualisation techniques will be used where possible to bring difficult concepts to life and highlight their practical applications e.g. the use of video clips and the building of a 3D model of a plasmid to visualise restriction digestion. Co-operative learning will be encouraged, whereby students will work together to complete revision activities (e.g. crosswords, double puzzles, word searches). These revision activities will be provided at the end of each topic. A learning platform (such as moodle) will be used as a repository of educational resources and as a means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

Assessment of the Molecular Biology module will include both continuous assessment (50%) and a terminal exam (50%). Students are required to attend a minimum of 75% of laboratory sessions. The final exam will examine the students knowledge of the module and assess the ability of the student to communicate that knowledge in a suitable manner. Formative assessments will be conducted at the end of each topic to evaluate student comprehension, learning needs and academic progress. These assessments will identify concepts that students are struggling to understand and skills they are having difficulty in acquiring. Continuous assessment will involve report writing, data analysis and assessment of laboratory skills. A key focus of this module is to develop the students report writing skills. To achieve this, students will be required to submit 3 formal laboratory reports. Prior to submission of the first report, a tutorial on report writing will be delivered. Students will peer assess each others reports using a supplied marking scheme in the form of a rubric. Other resources such as Harvard referencing, details on plagiarism and sample reports will all be made available. A follow up tutorial on "how to improve your lab report" will be delivered prior to submission of the second report. Two short assessments will also be given on data analysis. The students must reach an assigned gate (mark) in the final exam and achieve 40% overall to pass the subject.

Repeat Assessment Strategies

If a student fails to achieve 40% in the module they will be required to resit the exam, resubmit or submit laboratory reports, write a theory assignment or a combination of these. Repeat assessments will be decided on a case by case basis, and will be informed by the amount and quality of continuous assessment submitted during the semester, and the performance of the student in the final exam.

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|-----------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Self Assessment Quiz | - % | OnGoing | 1,2,3,4,5 |
| Practical Evaluation | Practical assessments | 15 % | Week 13 | 6,7,8 |
| Written Report/Essay | Practical reports | 22 % | OnGoing | 6,7,8 |
| Assessment | Data analysis | 13 % | OnGoing | 6,8 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | End of Term | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------|------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |

| | | | | |
|------------------------|----------------------|---------------------|---|--------|
| Lecture | Lecture | Computer Laboratory | 1 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |
| Independent Learning | Self Study | Not Specified | 8 | Weekly |

Required Reading Book List

Nelson, L., Cox, M., (2021). *Lehninger Principles of Biochemistry*. WH Freeman.
ISBN 1319381499 ISBN-13 9781319381493

Recommended Reading Book List

Harvey, A., (2016). *Molecular Cell Biology*. W. H. Freeman.
ISBN 1464183392 ISBN-13 9781464183393

Baker, A., (2014). *Molecular Biology of the Gene*. Benjamin-Cummings Publishing Company.
ISBN 0321762436 ISBN-13 9780321762436

Literary Resources

Additional reading and resources will be recommended by the lecturer.

Journal Resources

Additional reading and resources will be recommended by the lecturer.

Online Resources

Additional reading and resources will be recommended by the lecturer.

Other Resources

<http://www.dnai.org/>

Additional reading and resources will be recommended by the lecturer

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | PROCESS MICROBIOLOGY | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Dr. John Barrett Phd. | | |

Module Description

The aim of this module is to introduce the student to both the theory and practical aspects of microbiology related to the production of a range of biomedical products, including pharmaceuticals, medical devices and immunodiagnostic materials. Students will be provided with the opportunity to acquire knowledge of the subject matter through a variety of lecturer led activities and self-directed study. Such activities will include traditional and interactive lectures, problem solving and revision tutorials and laboratory practical classes. Theoretical and practical problems will be employed to assist students in the development of their analytical and problem solving capabilities.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|---|
| 1. | Understand microbial ecology and its relationship to biomedical products manufacture. |
| 2. | Understand the importance of environmental monitoring as a regulatory and quality control requirement. |
| 3. | Collect, manipulate and interpret numerical data relating to microbiological analysis. |
| 4. | Understand the importance of, and work in compliance with, health and safety policies and good laboratory practice as it pertains to microbiology laboratories. |
| 5. | Be able to design and execute experiments, systematically collect and analyze data, identify sources of error, and interpret the results and reach logical conclusions. |
| 6. | Operate basic laboratory instruments used in industrial microbiological monitoring. |
| 7. | Cooperate and work effectively with peers and be able to demonstrate a commitment to the process of developing such skills. |

Indicative Syllabus

Indicative Theory:

- 1. Ecology of micro-organisms in industrial environments.
- 2. Methods of control of micro-organisms in industrial environments.
- 3. Sterile products manufacture, non-sterile products manufacture.
- 4. Bioburden and pyrogen testing.
- 5. Sterility testing (sampling, test methods, repeat test criteria).
- 6. Industrial water treatment systems.
- 7. Industrial water quality standards (water for injection, sterile water for injection, water for inhalation, water for irrigation, purified water).
- 8. Air quality in industrial environments.
- 9. Environmental monitoring - water, air, personnel and work surface monitoring.
- 10. Identification of micro-organisms - genus level, species level.

Indicative Practical:

- 1. Bioburden testing - contact, surface swab and rinse method.
- 2. Air sampling - standard methods for sampling.
- 3. Personnel monitoring - garment sampling, finger sampling.
- 4. Water sampling - standard methods for sampling, cultivation, enumeration and identification of contaminants.
- 5. Pyrogen test - LAL and turbidometric test.
- 6. Sterility testing - USP and EP sterility test standard methods.

- 7. Environmental monitoring - test methods, interpretation of results and action limits.
- 8. Identification of micro-organisms.

Teaching and Learning Strategy

Assessment Strategy

Repeat Assessment Strategies

| Indicative Coursework and Continuous Assessment: | | 0 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Mid term assessment | 15 % | Week 7 | 1 |
| UNKNOWN | Health and safety compliance - safe handling of microbes, safety glasses compliance | 5 % | OnGoing | 4 |
| UNKNOWN | Post practical assessments | 30 % | OnGoing | 3,5,7 |
| UNKNOWN | Practical skills assessment | 10 % | OnGoing | 6 |
| UNKNOWN | Report preparation and submission | 5 % | OnGoing | 5 |

| End of Semester / Year Formal Exam: | | 100 % | | |
|-------------------------------------|--------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Final theory examination | 35 % | End of Term | 1,2 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-----------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Work | Science Laboratory | 2 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Literary Resources

Brock Biology of Microorganisms -

[Michael T. Madigan](#), [Kelly S. Bender](#) and Daniel H. Buckley

Edition: 15TH Copyright: 2018 Publisher: Pearson, Published: 2018

Text Only - 15th edition. ISBN13: 9780134261928

Microbiology: Laboratory Theory and Application, - 3rd edition

[Michael J. Leboffe](#) and [Burton E. Pierce](#)

Edition: 3RD 16 Copyright: 2016 Publisher: Morton Publishing Co.

Published: 2016. ISBN13: 9781617314773

Microbiology - 2nd edition

[Anthony Strelkauskas](#)

Edition: 2ND 16 Copyright: 2016 Publisher: Garland Publishing

Published: 2016. ISBN13: 9780815345138

Medical Microbiology - 8th Edition

[PhD \(Author\)](#), [Michael A. Pfaller MD \(Author\)](#)

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[Patrick R. Murray PhD \(Author\)](#), [Ken S. Rosenthal](#)

Published: 2019. ISBN-13: 978-

Medical Microbiology - 8th Edition

Elsevier

Patrick Murray Ken Rosenthal Michael Pfaller.

Published Date: 28th October 2015. ISBN: 9780323299565

Other Resources

Journals:

Annual Reviews in Microbiology
Microbiology and Molecular Biology Reviews
Nature Reviews in Microbiology
Trends in Microbiology

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SBIOM_C06 202100 Higher Certificate in Science in Biomedical Science
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science



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SCI06019 2022 Job Readiness (Science)

Mandatory Delivered in Stage 2 Semester 4

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Job Readiness (Science) | | |
| Status | Uploaded to Banner | Start Term | 2022 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Neville McClenaghan | | |
| Co Authors | Mary Butler, Eoin Gillespie, Yvonne Lang | | |

Module Description

This module is designed to support students undertaking science-based study, through providing insights into effective directed learning, self-study, self-reflection, communication, and time-management. This will facilitate awareness and development of personal effectiveness and employability attributes and skills as engaged learners.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Appreciate diverse styles, skills, and tools for effective learning/communication, personal effectiveness, and employability in science.
2. Evidence self-reflection/appraisal, critique, and writing/journaling skills applicable to life and work.
3. Illustrate learning from thought leaders in science, education, organization, and management.
4. Evidence effective time management/learning strategies and demonstrate personal engagement in relevant external reading and study.

Indicative Syllabus

1. Introduction to personal effectiveness/employability and overview of module learning.
2. Core study skills, approach to study/work, mind skills, and managing personal development.
3. Science learning and skills development.
4. Development of scientific language, literacy, presentation, and numeracy skills.
5. Preparing for a science career.
6. Interpersonal skills.
7. Personal leadership skills.
8. Science professionalism and self-appraisal.
9. Preparing for employment and career progression.
10. Hot topics (including adjusting to remote working).

Teaching and Learning Strategy

A range of learning and teaching methods will be used to support delivery of this module which is strategically designed to meet the needs of science students, including directed reading, self-assessment exercises, quizzes, and self-review and reflection. Students will have access to accessible course material anchored in the VLE, are encouraged to engage in active learning, and will participate in a range of specified learning activities (to include generation of a recorded "elevator pitch" style presentation).

Assessment Strategy

This module will be examined through continuous assessment that includes quizzes (through VLE), completion of a structured reflective personal development journal/portfolio, and submission of a recorded "elevator pitch" style presentation.

Repeat Assessment Strategies

The repeat assessment will require resubmission of continuous assessment work.

Additional Facilities

Indicative Coursework and Continuous Assessment:

100 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------|-------|---------|-------------------|-------------------|
|------|-------|---------|-------------------|-------------------|

| | | | | |
|------------|--|------|---------|-------|
| Assessment | Quizzes (through VLE) | 50 % | OnGoing | 1,3,4 |
| Assessment | Structured reflective journal/portfolio and recorded elevator pitch style presentation | 50 % | OnGoing | 1,2,4 |

Online Learning Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|----------------------|----------------------|-----------------|--------------|------------------|
| Independent Learning | Independent learning | Not Specified | 5 | Weekly |
| Lecture | Lecture | Online | 0.5 | Fortnightly |
| Tutorial | Tutorial | Online | 0.5 | Fortnightly |

Literary Resources**Journal Resources****Online Resources****Other Resources**

Relevant online and other resources as directed. Online resources include those provided through the VLE, library, journals, internet (TED talks, YouTube, etc.), and databases.

Programme Membership



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SCI06022 2023 Laboratory Professional Practice

Mandatory Delivered in Stage 2 Semester 4

| | | | |
|----------------------|---------------------------------------|-----------------------|-----------------------|
| Full Title | Laboratory Professional Practice | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Sarah Best | | |
| Co Authors | Margaret Doherty, Neville McClenaghan | | |

Module Description

This module is designed to support students in the personal development of Laboratory Professional Practice including competencies and skills required for safe laboratory working. As such, a key focus for this module will be safe working practices in a laboratory context building on earlier learning and underpinning further study. It is also envisaged that students will gain insights into laboratory sciences as they relate to a variety of industries through a combination of personal research and industry site visits.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Demonstrate knowledge and understanding of laboratory professional practice.
2. Recognise key aspects of health and safety in a laboratory context.
3. Classify biological, chemical, physical hazards as they relate to professional practice within the laboratory.
4. Demonstrate knowledge on the safe storage, use and disposal of laboratory chemicals.
5. Communicate information accurately and effectively.

Indicative Syllabus

1. Introduction to laboratory professional practice.
2. Overview of key aspects of Laboratory Health and Safety.
3. Introduction to biological, chemical, physical hazards as they relate to professional practice within the laboratory.
4. Introduction to laboratory health and safety and legislation including signage, material safety data sheets and other core aspects.
5. Safe storage of laboratory materials (Biological and Chemical).
6. Safe use of laboratory materials and equipment including risk assessment.
7. Safe disposal of laboratory materials.
8. Recording and reporting in a laboratory context and best practice.
9. Insights into laboratory sciences as they relate to a variety of industries.
10. Emerging developments in laboratory professional practice.

Teaching and Learning Strategy

Students will get a solid grounding in Laboratory Professional Practice. The module will enhance understanding of safe working practices as they relate to the life sciences industry building foundation knowledge to underpin further study.

This module will offer insights into laboratory sciences as they relate to a variety of industries through a combination of learning material, student personal research and industry site visits.

Assessment Strategy

The module will be assessed entirely by continuous assessment. This will comprise of multiple choice/short answer question assessments and written assignments throughout the semester.

Repeat Assessment Strategies

The repeat assessment will require resubmission of continuous assessment work.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 100 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | MCQ and Short Answer Questions | 70 % | OnGoing | 1,2,3,4,5 |
| Assessment | Written Assessment (Reflective Report on Professional Practice in Industry incl. Site Visits) | 30 % | Week 12 | 1,5 |

| Full Time Delivery Mode: | | | | |
|--------------------------|------------------------|---------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Not Specified | 2 | Weekly |
| Independent Learning | Self Directed Learning | Not Specified | 5 | Weekly |

| Recommended Reading Book List |
|--|
| Omale, J., (2011). <i>Basic Concepts in Laboratory Safety for Researchers and Students</i> . LAP Lambert Academic Publishing. ISBN 3845403276 ISBN-13 9783845403274 |

| Literary Resources |
|--------------------|
| |

| Online Resources |
|--|
| Health and Safety Authority Irish Legislation, EU Directives and Standards https://www.hsa.ie/eng/topics/atex/atex_delivery_guide/irish_legislation_eu_directives_standards/ |

| Other Resources |
|--|
| Relevant online and other resources as directed. |

| Programme Membership |
|----------------------|
| |



CHEM06051 2023 Instrumentation 1

Elective Delivered in Stage 2 Semester 3

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Instrumentation 1 | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will introduce the student to the theory and practice of instrumental analysis involving various spectroscopic and electroanalytical techniques. It will help develop a competence in instrument calibration, sample analysis and result's interpretation for each of the analytical methods covered.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain the principles behind atomic spectroscopy.
2. Explain the principles behind molecular spectroscopy.
3. Explain the principles behind ISE's and potentiometric analysis.
4. Discuss the principles behind polarography and voltametric analysis.
5. Identify and describe the essential components of each analytical instrument covered and how they are calibrated.
6. Demonstrate practical experience of each technique and compose a clear scientific record of each completed experiment in a written report.

Indicative Syllabus

Fundamentals of Spectroscopy

- Electromagnetic radiation and its interaction with matter
- Atomic and molecular energy levels
- Absorption laws

Instrumental Components of Spectroscopy

- Excitation sources and wavelength selectors
- Sample holders
- Detectors

Atomic and Molecular Spectroscopic Techniques

- AAS and AES
- UV/Vis and Fluorescence spectroscopy
- Infra-Red and Raman spectroscopy

Fundamentals of Electroanalysis

- Introduction to electrochemistry and electrode potentials
- Reference and Indicator electrodes (Ion selective electrodes)
- Potentiometry and Conductometric analysis

Fundamentals of Voltammetry

- Polarography, DME and HDME
- Linear Sweep Voltammetry and Cyclic Voltammetry.
- Anodic and Cathodic Stripping Voltammetry

Teaching and Learning Strategy

Laboratory Work, Lectures, Tutorials, Use of Blackboard as a repository

Assessment Strategy

Laboratory Work, Multi-Choice Questions, Project, Final Exam

Repeat Assessment Strategies

As per the University policy

Additional Facilities**Indicative Coursework and Continuous Assessment:**

50 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|--------------------|-----------------------|----------------|--------------------------|--------------------------|
| Open Book Exam | Class Test - MCQ | 5 % | Week 6 | 1,2,5 |
| Lab Report | Laboratory Practicals | 40 % | OnGoing | |
| Individual Project | Project | 5 % | Week 12 | |

End of Semester / Year Formal Exam:

50 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5,6 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|---------------------|--------------|------------------|
| Lecture | Lecture | Lecture Theatre | 3 | Weekly |
| Tutorial | Tutorial | Computer Laboratory | 1 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 3 | Weekly |
| Independent Learning | Independent Learning | Not Specified | 10 | Weekly |

Required Reading Book List

Skoog, A., West, M., Holler, F., Crouch, R., (2021). *Fundamentals of Analytical Chemistry*. ISBN 0357450396 ISBN-13 9780357450390

Christian, D., Dasgupta, K., Schug, A., (2013). *Analytical Chemistry*. John Wiley & Sons. ISBN 9780470887578 ISBN-13 0470887575

Recommended Reading Book List

Robinson, J., (2014). *Undergraduate Instrumental Analysis*. 7th Edition. CRC Press.

Literary Resources**Journal Resources****Online Resources**

www.sciencedirect.com

Other Resources**Programme Membership**



BIOC06013 2023 Biochemistry

Elective Delivered in Stage 2 Semester 3

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Biochemistry | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will introduce the learner to the major classes of bio-macromolecules encountered in biochemistry. It will provide an understanding of the structural, chemical and functional properties associated with these macromolecules.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe the structures of the major types of carbohydrates, lipids, proteins and nucleic acids.
2. Explain the biochemical properties and functions of carbohydrates, lipids, proteins, and nucleic acids.
3. Outline some of the major metabolic pathways involved in carbohydrate and lipid metabolism.
4. Demonstrate an understanding of the basic properties and functions of enzymes.
5. Describe the general structure and function of the cell membrane.
6. Demonstrate practical skills in the analysis of biomolecules.

Indicative Syllabus

Section A – Carbohydrates:

- Classification, structure and functions of carbohydrates
- Carbohydrate metabolic pathways

Section B – Lipids and Membranes:

- Classification, structure and function of lipids
- Membrane structure and function
- Lipid metabolism

Section C – Proteins:

- Protein structure
- Functional properties of proteins

Section D – Enzymes:

- General properties and enzyme classification
- Enzyme kinetics and factors affecting enzyme activity

Section E – DNA structure and function:

- Chemical and physical properties of DNA and RNA nucleic acids
- DNA replication, transcription and translation
- The genetic code

Teaching and Learning Strategy

Laboratory Work, Lectures, Tutorials, Use of Blackboard as a repository

Assessment Strategy

Laboratory work, Class Test, Final Exam

Repeat Assessment Strategies

As per the University policy

Additional Facilities**Indicative Coursework and Continuous Assessment:**

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|-----------------------|----------------|--------------------------|--------------------------|
| Lab Report | Laboratory Practicals | 40 % | OnGoing | 6 |
| Closed Book Exam | Class Test | 10 % | Week 6 | 1,2,3 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5,6 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|-----------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Lecture Theatre | 3 | Weekly |
| Tutorial | Tutorial | Lecture Theatre | 1 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 3 | Weekly |
| Independent Learning | Independent Learning | Not Specified | 10 | Weekly |

Required Reading Book List

Nelson, L., Cox, M., (2021). *Lehninger Principles of Biochemistry*. WH Freeman.
 ISBN 1319381499 ISBN-13 9781319381493

Literary Resources**Journal Resources****Online Resources**Dolan DNA learning centre accessed at www.dnalc.org**Other Resources****Programme Membership**

| | | | |
|----------------------|-------------------------------------|-----------------------|-----------------------|
| Full Title | Medicinal Drug Discovery and Design | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will introduce the learners to drug action, the basic concepts of drug design and the physiochemical properties of a molecule that are important in therapeutic action. It will demonstrate the important principles of drug delivery and the biological factors that affect these processes and provide an understanding of pharmacodynamics and pharmacokinetics.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Differentiate and classify drugs.
2. Describe the drug design and development process.
3. Discuss the pathway of the drug through the body and describe how the drug interacts with the target.
4. Outline the basic principles of structure-activity relationships.

Indicative Syllabus

Introduction

- History of drug design
- Leads and analogues
- Classification of drugs
- Stages of the drug design and development process

Drug Structure and Solubility

- Functional groups
- Stereochemistry
- Solubility
- pH and pKa

Pharmacodynamics and Pharmacokinetics

- Routes of administration
- Absorption, Distribution, Metabolism, Excretion
- Pharmacokinetics

Drug Targets

- Bonding
- Receptors
- Enzymes
- Nucleic Acids

Structure Activity Relationship

- Changing size and shape
- Introduction of new substituents
- Quantitative Structure Activity Relationships (QSAR)

Teaching and Learning Strategy

Case studies, Lectures, Tutorials, Use of Blackboard as a repository

Assessment Strategy

Essay, Multi-Choice Questions, Presentation, Final Exam

Repeat Assessment Strategies

As per the Univeristy policy

Additional Facilities**Indicative Coursework and Continuous Assessment:**

30 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|--------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Class Test | 10 % | Week 6 | 1,2,3,4 |
| Assignment | Essay | 10 % | Week 9 | 1,2,3,4 |
| Individual Project | Presentation | 10 % | Week 12 | 1,2,3,4 |

End of Semester / Year Formal Exam:

70 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 70 % | Week 15 | 1,2,3,4 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|----------------------|----------------------|-----------------|--------------|------------------|
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Independent Learning | Independent Learning | Not Specified | 8 | Weekly |

Required Reading Book List

Strmgaard, K., Krogsgaard-Larsen, P., Madsen, U., (2016). *Textbook of Drug Design and Discovery*. ISBN 1498702783 ISBN-13 9781498702782

Literary Resources**Journal Resources****Online Resources****Other Resources****Programme Membership**

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Ecosystems | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module provides the student with an introduction to ecological concepts and processes and an understanding of the functioning and exploitation of some terrestrial and aquatic ecosystems important in a regional context.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Define, explain, and use ecological terms and concepts.
2. Describe the abiotic environment in selected ecosystems and understand the importance of biogeochemical cycling.
3. Differentiate between biotic interactions from selected ecosystems.
4. Undertake fieldwork to identify and enumerate organisms from selected ecosystems.
5. Investigate interactions in the field between biotic and abiotic components of selected ecosystems.

Indicative Syllabus

Introduction to Ecology

- Ecosystems – definitions and examples
- Ecosystem characteristics and structure

Ecosystem Processes

- Ecological succession
- Ecosystem protection and legislation

Biogeochemical Cycles

- Nutrient reservoirs and nutrient movement
- Water cycle, carbon cycle, nitrogen cycle and phosphorus cycle

Biological Interactions

- Interactions categorised by effect e.g. neutralism, amensalism, antagonism and facilitation
- Interactions categorised by mechanism e.g. symbiosis and competition
- Interactions categorised by neither effect or mechanism e.g. detritivory and decomposition

Teaching and Learning Strategy

Field trips, Laboratory Work, Lectures, Use of Blackboard as a repository

Assessment Strategy

Final Examination, Laboratory work, Class test

Repeat Assessment Strategies

As per Univeristy policy

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Lab Report | Practicals | 40 % | OnGoing | 4,5 |
| Closed Book Exam | Class Test | 10 % | Week 6 | 1,2,3 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-----------------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 3 | Weekly |
| Independent Learning | Independent Learning | Not Specified | 3 | Weekly |

| Required Reading Book List |
|---|
| Begon, M., Townsend, R., (2021). <i>Ecology</i> . John Wiley & Sons. ISBN 9781119279358 ISBN-13 1119279356 |

| Recommended Reading Book List |
|--|
| Weathers, C., Strayer, D., Likens, E., (2013). <i>Fundamentals of Ecosystem Science</i> . Academic Press. ISBN 0120887746 ISBN-13 9780120887743 |

| Literary Resources |
|--------------------|
| |

| Journal Resources |
|-------------------|
| |

| Online Resources |
|------------------|
| |

| Other Resources |
|-----------------|
| |

| Programme Membership |
|----------------------|
| |

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Instrumentation 2 | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will introduce the student to the theory and practice of instrumental analysis involving a number of different chromatographic techniques. It will help develop a competence in instrument calibration, sample analysis and result's interpretation for each of the analytical methods covered.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain the principles behind the chromatographic separation of different components in a sample.
2. Explain the principles behind planar and open column chromatography.
3. Explain the principles behind gas chromatography (GC).
4. Explain the principles behind liquid chromatography (HPLC).
5. Identify and describe the essential components of each analytical instrument covered and how they are calibrated.
6. Demonstrate practical experience of each technique and compose a clear scientific record of each completed experiment in a written report.

Indicative Syllabus

Introduction to Chromatographic Separations

- General description of chromatography,
- Solute migration, retention and band broadening
- Column efficiency & theoretical plates

Planar Chromatography

- Traditional paper chromatography / Thin layer chromatography (TLC)
- Characteristics of TLC
- Qualitative and quantitative analysis

Gas Chromatography (GC)

- Principles of gas-liquid chromatography (GLC) and gas solid chromatography (GSC)
- Instrumentation for gas chromatography
- Applications of GC

High Performance Liquid Chromatography (HPLC)

- Principles of liquid chromatography and HPLC modes
- Instrumentation for liquid chromatography
- Applications of HPLC

Ion Exchange Chromatography (IEC) and Size Exclusion Chromatography (SEC)

- Principles of IEC and SEC
- Stationary phases used in IEC and SEC
- Applications of IEC and SEC

Teaching and Learning Strategy

Laboratory Work, Lectures, Tutorials, Use of Blackboard as a repository

Assessment Strategy

Laboratory work, Multi-Choice Questions, Project, Final Exam

Repeat Assessment Strategies

As per University policy

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|-----------------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Class Test: MCQ | 5 % | Week 6 | 1,2,5 |
| Individual Project | Independent Project | 5 % | Week 12 | 1,2,5,6 |
| Lab Report | Laboratory Practicals and Reports | 40 % | OnGoing | 5,6 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-----------------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Lecture Theatre | 3 | Weekly |
| Tutorial | Tutorial | Lecture Theatre | 1 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 3 | Weekly |
| Independent Learning | Independent learning | Not Specified | 6 | Weekly |

Required Reading Book List

Skoog, D., West, D., Holler, F., Crouch, S., (2013). *Fundamentals of Analytical Chemistry*. Cengage Learning. ISBN 0495558281 ISBN-13 9780495558286

Robinson, J., (2014). *Undergraduate Instrumental Analysis*. 1st Edition. CRC Press.

Recommended Reading Book List

Christian, D., Dasgupta, K., Schug, A., (2013). *Analytical Chemistry*. John Wiley & Sons. ISBN 9780470887578 ISBN-13 0470887575

Literary Resources

Journal Resources

Online Resources

www.sciencedirect.com

Other Resources

Programme Membership

| | | | |
|----------------------|------------------------------|-----------------------|-----------------------|
| Full Title | Fundamentals of Microbiology | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

The module aims to introduce prokaryotic and eukaryotic microorganisms, factors influencing their growth and survival and methods to control their proliferation. The learner will be familiarised with the methods used for cultivation, identification and enumeration of microorganisms.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Characterise the structure of prokaryotic and eukaryotic microorganisms and viruses.
2. Describe the conditions that affect growth and be able to exploit these to cultivate microorganisms.
3. Assess methods for the enumeration of microorganisms.
4. Discuss techniques used for the identification of microorganisms.
5. Discriminate between the principles of disinfection, sterilisation and asepsis.
6. Demonstrate the ability to manipulate, enumerate and identify microorganisms using aseptic techniques.

Indicative Syllabus

Structure of microorganisms

- Structure of prokaryotic and eukaryotic microorganisms
- Structure and replication of viruses

Nutrition and Metabolism

- Nutritional requirements and metabolism of microorganisms.
- Environmental factors affecting growth
- Manipulation of nutrients and conditions in microbial culture.

Enumeration and measuring growth

- Direct cell counts including total viable count and colony counting
- Indirect measurements of growth, use of the spectrophotometer to measure growth

Classification and Identification

- Classification of microorganisms
- The use of microscopy in the study of microorganism.

Control

- Principles of disinfection and sterilisation
- Physical and chemical methods to accomplish disinfection / sterilisation
- Indicators of sterilisation

Teaching and Learning Strategy

Laboratory Work, Lectures, Use of Blackboard as a repository

Assessment Strategy

Final Examination, Practicals, Class Tests

Repeat Assessment Strategies

As per University policy

Additional Facilities**Indicative Coursework and Continuous Assessment:**

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|-----------------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Class Test | 5 % | Week 6 | 1,2,4 |
| Closed Book Exam | Class Test | 5 % | Week 12 | 3,4,5 |
| Lab Report | Laboratory Practicals | 40 % | OnGoing | 1,2,3,4,5,6 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|-----------------------|--------------------|--------------|------------------|
| Lecture | Lectures | Lecture Theatre | 3 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 4 | Weekly |
| Independent Learning | Independent learning | Not Specified | 10 | Weekly |

Required Reading Book List

Madigan, T., Bender, S., Buckley, D., Sattley, W., Stahl, D., (2018). *Brock Biology of Microorganisms*. ISBN 0134261925 ISBN-13 9780134261928

Literary Resources**Journal Resources****Online Resources**

www.fems-microbiology.org
<http://www.sgm.ac.uk/>
<http://www.asm.org/>
<http://aem.asm.org>
<http://www.fda.gov/Food/>

Other Resources**Programme Membership**

| | | | |
|----------------------|---------------------|-----------------------|--------------------|
| Full Title | Biochemistry | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 10 |
| Delivery Mode | Year | Duration | Stage - (30 Weeks) |
| Grading Mode | Pass/Fail | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module examines the chemistry of life processes. Key chemical concepts that apply to biological systems are investigated, including the types of chemical bonds, the structure of water (an almost universal solvent in biochemical processes), the First and Second Laws of Thermodynamics, and the basic principles of acid-base chemistry.

The structures of the four main types of macromolecules found (with minor variations) in all living organisms are described and the close relationship between their respective structures and functions are examined. Various methods used to quantify and analyse proteins, polysaccharides, lipids, and nucleic acids are introduced and the theoretical bases of chromatographic and electrophoretic techniques, respectively, used in studying, developing, and manufacturing protein-based therapeutics are described.

The structures and functions of vitamins and their biological functions are overviewed and the function of enzymes as biological catalysts is evaluated in terms of structure, function, and mechanism of action.

The module also describes key metabolic concepts such as the generation of energy from the breakdown of glucose and other metabolites, along with an overview of the associated processes of tryacylglycerol, glycogen, and protein metabolism.

Students develop their practical skills by performing a range of laboratory experiments that focus on the purification and qualitative/quantitative analysis of macromolecules, the application of chromatographic techniques to the separation of biomolecules, and the analysis of enzyme activity and inhibition.

Sustainability is embedded in the biochemistry module. The use of paper is minimised by using soft copies of notes and continuous assessments. Signage is used in the laboratory to decrease energy consumption (i.e. turn off lights, close the fume hoods, turn off appliances). The use of washable and reusable glassware is encouraged, and plastic pipette tips are washed and reused. Water is conserved through vigilance in turning off taps and ensuring that there are no obvious water leaks.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Describe the key chemical concepts that apply to biological systems (chemical bonds, the structure of water, the First and Second Laws of Thermodynamics, acid-base chemistry) and their application.
- Identify the different types of macromolecular and their constituent subunits, describe their structures and structure-function relationships with reference to specific examples.
- Describe the structure and mechanism of action of enzymes, explain the role of cofactors in enzyme reactions with reference to specific examples and explain the different types of enzyme inhibitors and how they may be identified.
- Examine key metabolic processes in the metabolism of carbohydrates, proteins and lipids, discuss the importance of metabolites in the generation of energy and the processes involved, and the role of metabolites as intermediates in biosynthetic reactions.
- Conduct all laboratory work in compliance with relevant health and safety legislation/guidelines, and understand the relevant biological, chemical and physical hazards associated with working in the laboratory, apply appropriate standards and procedures for risk containment and be aware of risk assessment.
- Use a range of analytical instruments, equipment, procedures, and techniques to prepare and carry out laboratory experiments related to biomolecules and process, analyse, interpret, and document the results of qualitative/quantitative assays using reference standards/standard curves/specifications.

Indicative Syllabus

1. Key Chemical Concepts

Types of chemical bonds, the structure of water,
 The First and Second Laws of Thermodynamics,
 Acid-base chemistry and the practical aspects of buffer preparation, properties and uses.

2. Spectrophotometry.

The Beer Lambert law.
 The role of UV - visible spectrophotometry in the quantification of biomolecules.

3. Protein structure

The structure and chemical properties of amino acids.
 The primary, secondary, tertiary, and quaternary structure of proteins (globular and fibrous).
 Denaturation and handling of proteins.

4. Carbohydrates.

The structure and chemical properties of aldoses, ketoses, and all common monosaccharides particularly pentoses and hexoses.
 Qualitative and quantitative measurement.
 Common disaccharides and polysaccharides - their chemistry and quantification.

5. Lipids

The structures & functions of lipids
 Triacylglycerol structure - fatty acid structures and characteristics, essential fatty acids.
 Cholesterol structure and function - derivatives of cholesterol (steroid hormones)
 Cell membrane structure - phospholipid structure, derivatives of phospholipids, prostaglandins

6. Nucleic acids.

Nucleotide structure,
 Polynucleotide structure, the double helix, chemical bonds, nucleosomes, rosettes, chromosomes, tRNA, rRNA, and mRNA.
 Chemical properties of DNA (i.e. effect of heat, alkali, UV absorbance at 260 nm).
 Quantification of DNA in the laboratory

7. Vitamins

Fat-soluble vitamins - structure and function
 Water-soluble vitamins - structure, function and role as cofactors

8. Enzymes

Classification of enzymes
 Structure of enzymes - the active site.
 Mechanism of action.
 The role of enzymes as biological catalysts.
 Factors that affect enzyme activity.
 Basic enzyme kinetics - activation and inhibition of enzymes, enzyme assays (fixed time and continuous enzyme assay).
 Use of enzymes to quantify biomolecules (immunoassay)

9. Metabolic Processes

Carbohydrate metabolism - the generation of energy from fuel molecules, glycolysis, TCA cycle, oxidative phosphorylation, the pentose phosphate pathway, glycogen metabolism, gluconeogenesis,
 Protein turnover in the cell - ubiquitin, the proteasome, urea cycle, generation of metabolic intermediates
 Lipid metabolism - oxidation of fatty acids, ketone bodies
 Regulation of metabolism

10. Practical Laboratory Techniques

A review of the theoretical basis and applications of the following techniques:
 Centrifugation, Chromatographic techniques (thin layer, gel filtration, ion exchange), electrophoresis.

Teaching and Learning Strategy

Teaching and learning strategies include lectures, tutorials, the provision of online additional notes, videos, activities, formative assessments, and laboratory practicals. Lectures are supported by PowerPoint slides and technology-enhanced learning tools that are available to the students via Moodle. Practicals will involve students working individually, and in groups, to gain experience and competence in a range of biochemical and analytical techniques.

Assessment Strategy

The module is assessed by continuous assessment (CA) (30 %), laboratory assessment (30 %), and final written examination (40 %) are used to mark student performance.

CA (30% of total grade) involves various methodologies such as Moodle quizzes, posters, and presentations that examine specific learning outcomes.

Practical evaluation (30% of total grade) uses various methodologies such as Moodle quizzes, laboratory reports, and data analyses that will be co-assessed (where appropriate) with the Data Handling module to reduce the volume of assessment, increase the students' analytical skills, integrate the modules, and facilitate more in-depth engagement with the practical procedures and underlying theory.

The end-of-year written examination (40% of total grade) is a two-hour written examination.

To be awarded a pass in this module a candidate must achieve a minimum of 35 % in each individual component of the module. If the mark for any component (i.e., continuous assessment, practical, final examination) falls below 35 %, the result for the module will be entered as a failed element (FE).

To achieve greater than 35 % in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module (i.e., in the next academic year).

Repeat Assessment Strategies

Repeat assessments are available in accordance with Galway Mayo Institute of Technology Academic Code of Practice No. 3: Student Assessment Marks and Standards.

The final written examination repeat is offered in August/September of the current academic year.

The practical element of the module may be repeated by repeat attending the module.

Additional Facilities

Indicative Coursework and Continuous Assessment:

%

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|------------------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Moodle Quiz | 10 % | Week 5 | 1,5 |
| Assignment | CA2 | 10 % | Week 12 | 2 |
| Assignment | CA3 | 10 % | Week 25 | 3 |
| Assignment | Laboratory Performance | 30 % | OnGoing | 6 |

End of Semester / Year Formal Exam:

%

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|---------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Written Paper | 40 % | End of Year | 4,6 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|--------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Not Specified | 3 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Nelson, L., (2016). *Principles of Biochemistry 7e*.
ISBN 1464126119 ISBN-13 9781464126116

Literary Resources

Journal Resources

Online Resources

Other Resources

Programme Membership

| | | | |
|----------------------|---------------------------|-----------------------|-----------------------|
| Full Title | Analytical Techniques 2.1 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

Analytical Techniques 2.1 module combines theory with practical work so that the student has a comprehensive knowledge of spectroscopic and chromatographic techniques for qualitative and quantitative analysis of organic and inorganic chemical entities. From the theory the student learns the basic methods of spectroscopy which include uv/visible radiation, fluorescence, atomic absorption, flame absorption, infra-red and ¹H-NMR spectrometry. The student also learns the basic methods of chromatography which include gas chromatography, high performance liquid chromatography, thin layer, ion- exchange, column and paper chromatography. Through practical work the student learns how to follow procedures, to prepare samples for analysis, use mathematical methods to process analytical data, obtain quantitative results and report results in a proper manner.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Display a knowledge of the basic theoretical principles underlying methods of spectroscopic and chromatographic analysis.
2. Follow procedures and prepare samples for analysis by spectroscopic and chromatographic techniques.
3. Operate a wide range of analytical instrumentation under supervision.
4. Process analytical data and obtain quantitative results.
5. Write reports using mathematical methods.
6. Assess the validity of the results.

Indicative Syllabus

Theory:

Spectrophotometric Methods of Analysis

Electromagnetic radiation: interaction with atoms and molecules, Application of Beer-Lambert Law

Atomic Spectroscopy: Flame emission and atomic absorption spectrometry, Instrumentation for measurements, quantitative aspects.

Molecular Spectrometry.: Absorption of uv/visible radiation, fluorescence, Infrared spectrometry

Chromatographic Methods of Analysis: Gas Chromatography (GC), carrier gases, columns: packed and capillary, Detectors: flame ionization & thermal conductivity. Efficiency of separation: resolution, theoretical plates, plate height. Band broadening and the Van Deemter equation. Isothermal and temperature programmed analysis. Use of internal and external standards.

Liquid Chromatography (LC): High Performance Liquid Chromatography (HPLC), Isocratic and gradient modes of elution' Normal and reverse phase modes of elution, Mobile phases, stationary phases, injection loops.

Basic Separation techniques: Thin Layer Chromatography (TLC), Ion exchange Chromatography, Column and paper Chromatography, Practical Programme:

Students will carry out experiments in the following areas: UV/VIS Spectrometry, Atomic absorption Spectrometry, Flame emission Spectrometry, Fluoresce, Infrared Spectroscopy, High Performance Liquid chromatography, Gas Chromatography, Thin Layer Chromatography, Ion Exchange Chromatography

Teaching and Learning Strategy

2 hours of lectures delivered with core content uploaded to moodle each week.

Continuous assessment carried out using a variety of assessment methods - on moodle 10 x 3hr laboratory experiments carried out with lab reports submitted online for assessment weekly.

End of semester exam - 2hr written exam on computer

Assessment Strategy

Continuous assessment - on moodle - using a variety of assessment methods

Laboratory report submitted & assessed weekly - 35% required to compile to pass

End of semester exam -2hr written exam - on computer - 35% required to compile to pass

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat final Exam

Additional Facilities

Indicative Coursework and Continuous Assessment:

60 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|--|---------|-------------------|-------------------|
| Closed Book Exam | A variety of online assessments Spectroscopy | 5 % | Week 6 | 1,4,5,6 |
| Lab Report | Practical Evaluation, Laboratory Report Spectroscopy | 25 % | OnGoing | 1,2,3,4,5,6 |
| Closed Book Exam | A variety of online assessments Chromatography | 5 % | Week 12 | 1,4,5,6 |
| Lab Report | Practical Evaluation, Laboratory report Chromatography | 25 % | OnGoing | 1,2,3,4,5,6 |

End of Semester / Year Formal Exam:

40 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|--|---------|-------------------|-------------------|
| Closed Book Exam | Final Exam End of Semester - on computer | 40 % | End of Semester | 1,2,3,4,5,6 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|-------------|--------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2.5 | Weekly |

Required Reading Book List

Khopkar, S., (2008). *Basic Concepts of Analytical Chemistry*. New Age Science. ISBN 1906574006 ISBN-13 9781906574000

Christian, D., Dasgupta, K., Schug, A., (2013). *Analytical Chemistry*. John Wiley & Sons. ISBN 9780470887578 ISBN-13 0470887575

Literary Resources

HARRIS, D.C (2002) QUANTITATIVE CHEMICAL ANALYSIS 6 Ed FREEMAN

HARRIS, D.C.(2004) EXPLORING CHEMICAL ANALYSIS 3 Ed FREEMAN

Journal Resources

| |
|-------------------------|
| Online Resources |
| |

| |
|--|
| Other Resources |
| Lecture notes on moodle Laboratory Manual provided Videos of Laboratory Experiments - pre lab activity |

| |
|-----------------------------|
| Programme Membership |
| |

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | Molecular Biology 2.1 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

Introductory module on the characterization of DNA & RNA and their manipulation and analysis.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe the structure, replication, transcription, and translation of prokaryotic and eukaryotic DNA.
2. Describe the nature of key manipulative enzymes that are used to analyze DNA and RNA sequences.
3. Recognize the equipment, reagents and protocols that are required to target, to digest, and to amplify DNA/cDNA-RNA.
4. Undertake general calculations for reagent preparation from stock samples.
5. Apply theory-based knowledge to process and analyze DNA gel bands and DNA sequences in-silico using a suite of online tools.
6. Use appropriate reagents & equipment to quantify, visualize, and manipulate DNA samples.

Indicative Syllabus

Micropipette calibration and proper handling of micropipettes.
 General Molecular Biology Laboratory calculations
 Restriction digestion of DNA
 Familiarization with online restriction enzyme tools that define appropriate restriction buffers, appropriate enzymes, expected bands sizes and expected band patterns.
 Making up agarose gels and running samples in same using gel electrophoresis apparatus.
 Gel image capture and fragment size determination using image analysis software
 PCR set-up: reaction mix calculations; correct order of reagent additions; thermocycler programming.
 Spectrophotometric analysis of microlitre volumes of DNA samples to generate spectral plots and to determine purity and concentration.

Teaching and Learning Strategy

Teaching will consist of practical laboratory training sessions and tutorial-style lectures with an emphasis on class participation activities. Delivery will be based upon student pre-reading of chosen topics from text notes and online resources including Moodle. Learning will consist of Moodle-based assignments that encourage the student to actively engage with multimedia resourced information and through the use of a tutorial forum where students can discuss course content among their peers and with the lecturer.

Assessment Strategy

Practical Evaluation (40% of total) will consist of (1) Moodle-based assignments that place particular emphasis on problem-solving and encourage student exploration/discovery of more in-depth knowledge of practical protocols and theory (30%). (2) An end-of-term practical examination will also be included (10%)
 CA (20%) will consist of Moodle-based post-lecture online examinations that assess the students' knowledge level of lecture theory content.

Final Theory Paper (40%) will be delivered via electronic format and will consist of questions in a variety of formats (MCQ, Cloze, Match, Calculations, Short Answers, True/False, Short Descriptions, Figure and Graph labelling and/or interpretation).

Repeat Assessment Strategies

A repeat Final Theory paper will be offered in the Autumn. Ongoing Practical assessments and Theory assessments will not be offered - not achieving a minimum mark of 35/100 for either of these elements upon completion of the module will require the student to repeat the module in the following academic year.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 60 % | | |
|--|--------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Practical CA | 40 % | OnGoing | 2,3,4,5,6 |
| Closed Book Exam | Theory CA | 20 % | OnGoing | 1,2,5 |

| End of Semester / Year Formal Exam: | | 40 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 40 % | End of Semester | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Lecture Theatre | 1 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Clark, P., Russell, L., (2010). *Molecular Biology Made Simple and Fun*. ISBN 18898899097 ISBN-13 97818898899091

Kratz, R., (2020). *Molecular & Cell Biology For Dummies*. John Wiley & Sons. ISBN 9781119620402 ISBN-13 1119620406

Literary Resources

Journal Resources

As directed by academic staff.

Online Resources

As directed by academic staff.

Other Resources

As directed by academic staff.

Programme Membership



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GMIT06026 2024
Microbiology 1

Elective Delivered in Stage 2 Semester 3

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Microbiology 1 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module explores some of the fundamental aspects of Microbiology with a strong emphasis on laboratory skills associated with aseptic technique and the culture of microorganisms. The module will incorporate bacterial culture techniques, preservation, staining & observation. The module will also introduce methodologies associated with bacterial enumeration.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|---|
| 1. | Successfully stain and visualise microorganisms using the compound microscope. |
| 2. | Isolate, purify and preserve bacterial cultures. |
| 3. | Prepare different media types and utilise same for culture of microorganisms. |
| 4. | Enumerate bacterial cells using a viability count method. |
| 5. | Perform aseptic technique with emphasis on liquid and solid culture inoculations. |
| 6. | Describe different methods that are used to control the growth of microorganisms. |
| 7. | Discuss the importance of metabolism in the generation of energy and synthesis of important compounds in bacterial cells. |

Indicative Syllabus

Basic Principles of Microbiology

- Introduction to Microbiology.
- Discovery in Microbiology.
- Laboratory Safety Requirements and Safe Practices for handling microorganisms.

Microscopy, Cell Structure & Microbial Diversity

- Microscopy Principles and Technologies.
- Cell Structure, Morphology, Staining & Observation.
- History of Evolution.
- Microbial Diversity.

Nutrition, Culture & Metabolism of Microorganisms

- Aseptic technique, liquid culture inoculation, spread and streak plating.
- Colony morphology determination and selective enrichment.
- Nutrition and Culture of Microorganisms.
- Media Classification and media preparation.
- Isolation, Purification & Preservation of Bacteria.
- Sterilisation of Media/Equipment using heat and Membrane Filtration.
- Bioenergetics.
- Catabolism.

Microbial Growth

- Bacterial Cell Division.
- Population Growth.
- Microbial Growth Measurement (Direct & Indirect) Determination Techniques.
- Batch & Continuous Cultures.

- Factors affecting growth.
- Enumeration of Microorganisms.

Microbial Growth Control

- Physical Antimicrobial Control.
- Chemical Antimicrobial Control.
- Antimicrobial Agents used *in vivo*.

Teaching and Learning Strategy

The Microbiology module will encompass student-centred presentations, interactive videos, tutorials & practical laboratory activities. The module will also use smart technology to assess students' assimilation of information during class. This will allow real-time collation of information pertaining to student learning and will facilitate re-iteration of potentially problematic areas regarding learning.

Assessment Strategy

Module assessment incorporates a continuous assessment component, which includes laboratory assessment along with theory-based assessment. There is also a formal end-of-semester examination. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat formal end-of-semester examinations are set for repeat students. Repeat theory CA exams will be offered, and repeat practical exams may be offered depending on the circumstances associated with the failure of this element. Repeat assessments will be in line with GMIT Academic Code of Practice No 3 - Student Assessment: Marks & Standards.

Additional Facilities

Indicative Coursework and Continuous Assessment:

50 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|--|---------|-------------------|-------------------|
| Open Book Exam | Online quizzes (various formats) | 20 % | OnGoing | 2,3,4,5 |
| Skills Evaluation | Online Assessments and Practical Laboratory Assessment | 30 % | OnGoing | 1,2,3,4,5 |

End of Semester / Year Formal Exam:

50 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|-----------------------------|---------|-------------------|-------------------|
| Closed Book Exam | End-of-Semester Examination | 50 % | End of Semester | 1,2,4,6,7 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|-------------|--------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 3 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 1.5 | Weekly |

Required Reading Book List

Willey, M., Sherwood, L., Woolverton, J., (2017). *Prescott's Microbiology*. ISBN 9813151269 ISBN-13 9789813151260

Madigan, T., Bender, S., Buckley, H., Sattley, W., Stahl, A., (2018). *Brock biology of microorganisms*. Pearson Higher Education. ISBN 1292235101 ISBN-13 9781292235103

Willey, M., (2019). *Prescott's Microbiology*. ISBN 1260211886 ISBN-13 9781260211887

Literary Resources

Journal Resources

Journal articles will be provided as required.

Online Resources

Links will be provided on an ongoing basis.

Other Resources

Laboratory materials. This will be communicated to students upon initiation of the course.

Programme Membership



GMIT06021 2024 Data Modelling and Statistics

Elective Delivered in Stage 2 Semester 3

| | | | |
|----------------------|-------------------------------|-----------------------|-----------------------|
| Full Title | Data Modelling and Statistics | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

The module encompasses analysing data, summarising it concisely, modelling it for presentation it and extracting all significant information therefrom. Skills in Interpreting mathematical statements will be imparted. Following an introduction to basic statistics a range of statistical tests will be studied and the best available statistical test(s) will be employed to arrive at decisions based on the data presented. Suitable theoretical models will be proposed to explain observed measurements.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Record, model, present, analyse and interpret experimental data performing logarithmic transformation and regression when appropriate
- Suitably manipulate and transform equations in order to simplify the process being described and to extract desired parameters.
- Calculate the probability of an event and the expectation from a given distribution.
- Implement various mathematical and statistical operations, tests and computations for making quantitative decisions about a process or processes.

Indicative Syllabus

Physical, Chemical and Biological Mathematics

Fundamental mathematical functions and their graphs (linear, quadratic, inverse, power, exponential, logarithmic): Generating, plotting and analysing these in Excel.

Physical, chemical and biological applications of mathematics: Growth and decay, doubling time, Beer-Lambert law and absorbance curves in Excel.

Manipulation of mathematical expressions: Cooling time, role of logarithms.

Measurement and Presentation of Data

Basics of measurement: Errors. Measures of centrality, dispersion and skewness.

Presentation of data: Grouped data. Histograms. Frequency curves.

Charts in Excel: Column, line, X-Y scatter, pie, bar, histograms and 3-D charts.

Straight line equations. Correlation and regression. Measuring linearity.

Transforming data in Excel. Graphs of linearised expressions in Excel, log-log and semi-log graphs.

Basic Statistical Procedures

Basics of Probability: Statistical independence. Addition and multiplicative laws.

Special distributions: Binomial, Poisson, Normal, Student's 't' - with Excel also.

Sampling: Methods of sampling. The distribution of the sample mean - central limit theorem.

Confidence intervals on the mean: Large and small samples. z- and t- intervals in Excel.

Simple hypothesis testing - one-tailed and two-tailed tests. Levels of significance.

One-sample t-test, two-sample t-test, paired t-test.

Teaching and Learning Strategy

Lectures, videos & worked examples. OneNote is used extensively to demonstrate solutions to mathematical & statistical problems.

Practical work in PC suites using both handouts and screen casts.

Assessment Strategy

Weekly Computer based Labs are used to facilitate students in learning the required techniques. Assessment FOR learning is facilitated by giving students comprehension quizzes related to the lab tasks. Assessment AS learning occurs through the provision of solutions to the tasks on closure of the weekly comprehension

quizzes. Assessment OF learning is achieved through the completion of two theory assessments and one practical assessments as follows:

Written Assessment #1 covering theory Learning Outcomes #1 and #2

Written Assessment #2 covering theory Learning Outcomes #3 and #4

Computer based Assessment #3 covering practical implementation of Learning Outcome #1 to #4

Repeat Assessment Strategies

Repeat exam comprising both written and computer based sections:

Section A to cover Learning Outcomes #1,2,3,4 mathematical & statistical theory

Section B to cover Learning Outcome #1,2,3 and 4 Excel skills.

Additional Facilities

Indicative Coursework and Continuous Assessment:

100 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|-------------------|---------|-------------------|-------------------|
| Closed Book Exam | CA#1 | 30 % | Week 6 | 1,2 |
| Closed Book Exam | CA#2 | 30 % | Week 12 | 3,4 |
| Skills Evaluation | Excel Exam | 30 % | Week 13 | |
| Lab Report | Weekly Excel Labs | 10 % | OnGoing | 1,2,3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|-------------|---------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Computer Laboratory | 2 | Weekly |

Required Reading Book List

Adam, C., (2010). *Essential Mathematics and Statistics for Forensic Science*. Wiley.
ISBN 0470742526 ISBN-13 9780470742525

Hibbert, D., Of, P., Gooding, J., (2006). *Data Analysis for Chemistry*. OUP USA.
ISBN 9780195162103 ISBN-13 0195162102

van Emden, F., (2019). *Statistics for Terrified Biologists*. John Wiley & Sons.
ISBN 9781119563679 ISBN-13 1119563674

Ashcroft, S., Pereira, C., (2002). *Practical Statistics for the Biological Sciences*. Palgrave.
ISBN 0333960440 ISBN-13 9780333960448

Rowe, P., (2007). *Essential Statistics for the Pharmaceutical Sciences*. LibreDigital.
ISBN 0470034688 ISBN-13 9780470034682

Recommended Reading Book List

Liengme, B., (2015). *A Guide to Microsoft Excel 2013 for Scientists and Engineers*. Academic Press.
ISBN 9780128028162 ISBN-13 0128028165

Literary Resources

Journal Resources

Online Resources

Other Resources

Programme Membership

| | | | |
|----------------------|----------------------|-----------------------|-----------------------|
| Full Title | Quality Management I | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module will provide the student with an introduction to Quality Management. The module will equip students with a number of tools that are essential components of a good manufacturing practice compliant company. Students will learn how to draft a Standard Operating Procedure and populate a CAPA form based on a sample Non Conformance.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|--|
| 1. | Discuss the role and function of Quality within the laboratory and Industry, and differentiate between QA and QC. |
| 2. | Outline the role and function of GLP, GCP, GMP in the context of the drug development life cycle. |
| 3. | Construct Standard Operating Procedures, non-conformance reports and CAPAs in line with regulatory guidelines. |
| 4. | Appreciate the growing dependence on automated systems, software and data in a manufacturing context and the importance of equipment and automated system validation and data integrity. |
| 5. | Identify the responsibilities of the employee and employer with regard to health and safety in the laboratory and industry. |
| 6. | Recognise opportunities for more sustainable practice within industry, specifically with respect to electronic record and data management. |

Indicative Syllabus

1. Introduction to Quality Management Systems
2. Overview of the Drug and Medical Device Development Life Cycles
3. Differentiation between and importance of Quality Assurance and Quality Control.
4. The importance of the CAPA system in a GMP compliant company with case studies and interactive exercises.
5. Documentation, GDP and the role of SOPs in a GMP compliant company (this section will encompass the draft of an appropriate SOP).
6. Differentiation between GLP, GCP and GMP.
7. Introduction to Validation of equipment and automated systems in a manufacturing context including data integrity.
8. Regulatory Agencies and Notified Bodies and an introduction to Health and Safety legislation in the laboratory environment.

Teaching and Learning Strategy

Teaching and learning will be carried out using traditional lectures and presentations and interactive exercises based around appropriate Quality related issues. Computer laboratory sessions may be used if appropriate.

Assessment Strategy

The module is 100% continuous assessment. Exercises in drafting of non-conformance reports and SOPs given appropriate scenarios & group exercises including group presentations. This module will also encompass written assessments to determine students' knowledge in module content.

Repeat Assessment Strategies

Repeat assessments will be set dependent on individual components to be repeated.

Additional Facilities

Indicative Coursework and Continuous Assessment:

100 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|--|----------------|--------------------------|--------------------------|
| Assessment | Midterm Moodle knowledge quiz | 25 % | Week 6 | 1,2,3 |
| Group Project | Group assignment and presentation based on NC, CAPA system, and SOP drafting | 40 % | Week 8 | 3,4,6 |
| Closed Book Exam | End of term Moodle knowledge quiz | 25 % | End of Semester | 1,2,3,4,5,6 |
| Skills Evaluation | Participation - Engagement in class and with the module VLE | 10 % | OnGoing | |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|-------------|--------------------|-----------------|--------------|------------------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |

Required Reading Book List

Montgomery, C., Jennings, L., Pfund, E., (2010). *Managing, Controlling, and Improving Quality*. Wiley.
ISBN 0471697915 ISBN-13 9780471697916

Sower, E., (2010). *Essentials of Quality with Cases and Experiential Exercises*. John Wiley & Sons.
ISBN 9780470509593 ISBN-13 0470509597

Literary Resources

US, British and European pharmacopoeias

Journal Resources

Online Resources

- The Health Products Regulatory Authority - <http://www.hpra.ie/>
- National Standards Authority of Ireland - <http://www.nsai.ie/>
- U.S. Food and Drug Administration - <http://www.fda.gov/>
- European Medicines Agency - <http://www.ema.europa.eu/ema/>
- EU legislation. News and articles on Pharmaceutical Products - https://ec.europa.eu/info/index_en

Other Resources

Programme Membership

| | | | |
|----------------------|---------------------------|-----------------------|-----------------------|
| Full Title | Analytical Techniques 2.2 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

Semester-long module will consist of two hours of theory and two hours of practical work per week.

Analytical Techniques 2.2 module combines theory with practical work covering the basic techniques used in electrochemical and water analysis. The student will use pH and conductivity meters, various ion selective electrodes and employ use of titration to confirm the analytical methods.

Through the practical work the student learns how to follow procedures, to prepare samples for analysis, use mathematical methods to process analytical data, obtain quantitative results and report results in a proper manner.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|--|
| 1. | Understand the basic theory of instrumental methods in electrochemistry. |
| 2. | Operate a range of electrochemical instrumentation. |
| 3. | Prepare and use samples in qualitative and quantitative analysis. |
| 4. | Determine the composition of real samples. |
| 5. | Select the correct analytical technique for analysis. |
| 6. | Assess the validity of experimental data. |
| 7. | Compare test results with expected results. |
| 8. | Appreciate the importance of applying specific procedures in electrochemical and water analytical analysis to ensure reliability and accuracy of any data obtained and reported. |

Indicative Syllabus

1. Acids and Bases

- Conjugate pairs
- Dissociation constants
- pH scale
- Indicators
- Titration curves
- Buffers

2. Conductivity

- Conductivity of solutions
- Measurement of solution resistance - Wheatstone bridge
- Conductance Vs Conductivity
- Molar Conductivity
- Theory of strong electrolytes
- Limiting molar conductivity
- Ionic activity and ionic strength

- Conductimetric titrations
- Conductivity meter

3. Galvanic Cells and Electrodes

- Redox reactions
- Half cells
- Cell potential
- The Nernst Equation
- Electrodes of the first and second kind.
- Silver/silver chloride and calomel reference electrodes
- Redox electrodes
- Glass, solid state and liquid membrane electrodes.
- Gas sensing cells.
- Ion selective electrodes
- Incremental methods

Teaching and Learning Strategy

Teaching and learning will comprise:

- Team work
- Problem-based learning
- Formative assessments

Moodle will be the primary learning technology for communication and accessing lecture material.

Assessment Strategy

Assessment will comprise:

- Written continuous assessments (CA) - 20 %
- Evaluation of lab participation and reporting - 40% - MUST PASS
- Final Exam worth 40% - MUST PASS

Repeat Assessment Strategies

Repeat formal end-of-semester examinations are set for repeat students.

Repeat practical exams may be offered depending on the circumstances associated with the failure of this element.

Repeat assessments will be in line with Academic Code of Practice No 3 - Student Assessment: Marks & Standards.

Additional Facilities

Indicative Coursework and Continuous Assessment:

60 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|----------------------|---------|-------------------|-------------------|
| Skills Evaluation | Practical Evaluation | 40 % | OnGoing | 1,2,3,4,5,6,7,8 |
| Open Book Exam | Online Assessments | 20 % | OnGoing | 1,6,7 |

End of Semester / Year Formal Exam:

40 %

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|------------------------|---------|-------------------|-------------------|
| Closed Book Exam | End of Term Final Exam | 40 % | End of Semester | 1,4,5,6,7,8 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|-------------|--------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Skoog, D., West, M., Holler, F., (2013). *Skoog and West's Fundamentals of Analytical Chemistry*. ISBN 1408093731 ISBN-13 9781408093733

Wang, J., (2006). *Analytical Electrochemistry*. Wiley-VCH. ISBN 0471678791 ISBN-13 9780471678793

Girault, H., (2004). *Analytical and Physical Electrochemistry*. EPFL Press. ISBN 0824753577 ISBN-13 9780824753573

Browne, R., (2018). *Electrochemistry*. ISBN 9780198790907 ISBN-13 0198790902

Literary Resources

Skoog, West, Holler. (2003) *Fundamentals of Analytical Chemistry*. Saunders College Publishing.

Journal Resources

Online Resources

<https://www.sciencedirect.com/>

<https://www.chemguide.co.uk/>

<https://www.chemistryireland.org/>

Other Resources

Laboratory Manuals

Students will be supported in identifying additional relevant reading material as required.

Programme Membership

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | Molecular Biology 2.2 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module describes the major advances in 21st century molecular biology approaches to the fields of clinical diagnostics, nucleic acid therapies, and online fundamental bioinformatic resources applying to these disciplines. General gene cloning approaches in the initial has of biopharmaceutical production are also described. A suite of appropriate wet and dry laboratory techniques will be included.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Describe the genomic features that underlie clinical conditions and serve as targets for biopharmaceutical development and interventions.
- Describe the epigenome, its role in phenotype expression, and the external factors that can detrimentally alter it during one's lifespan and through future generations.
- Appreciate the ever-increasing influence of Next Generation Sequencing (NGS) methodologies in medical diagnostics and the subsequent development of precision clinical therapies.
- Appreciate the importance of modern gene manipulation tools, with emphasis on CRISPR.
- Use appropriate bioinformatics tools and web sites to examine and understand clinical conditions in detail.
- Use a variety of molecular biology laboratory instruments and associated protocols that are in general use in routine and clinical laboratories.

Indicative Syllabus

Genetic basis of diseases.

PCR, RT-PCR, qPCR, RT-qPCR, Digital PCR – theory, set-up, thermocycler programming,

Genomic DNA – practical work involving isolation, target regions amplification, post-PCR analyses including further wet laboratory work and online bioinformatics analyses.

Primer Design using appropriate online programmes for design and verification of primer robustness.

Epigenetics – theory, relevance, and a practical component to demonstrate its presence.

CRISPR – theory with a practical component to demonstrate variation

Genome – gene and intergenic sequence variations and their association with disease.

Gene cloning – theory and practical work.

Nucleic Acid Therapies, including RNAi – design and delivery.

Teaching and Learning Strategy

Teaching will consist of practical laboratory training sessions and tutorial-style lectures with an emphasis on class participation activities. Delivery will be based upon student pre-reading of chosen topics from text notes and online resources including Moodle. Learning will consist of Moodle-based assignments that encourage the student to actively engage with multimedia resourced information and through the use of a tutorial forum where students can discuss course content among their peers and with the lecturer.

Assessment Strategy

Practical Evaluation (40% of total) will consist of (1) Moodle-based assignments that place particular emphasis on problem-solving and encourage student exploration/discovery of more in-depth knowledge of practical protocols and theory (30%). (2) An end-of-term practical examination will also be included (10%)

CA (20%) will consist of Moodle-based post-lecture online examinations that assess the students' knowledge level of lecture theory content.

Final Theory Paper (40%) will be delivered via electronic format and will consist of questions in a variety of formats (MCQ, Cloze, Match, Calculations, Short Answers, True/False, Short Descriptions, Figure and Graph labelling and/or interpretation).

To be awarded a pass in this module a candidate must achieve 40% in the overall course work with a minimum of 35% being achieved for each of the three individual elements that the module is composed of. An overall module mark between 35-39% may allow the module to be compensated for by the candidate's performance in other course modules but only in accordance with current marks and standards regulations.

Repeat Assessment Strategies

A mark of less than 35% for either the Practical element or the CA element may require repeating the element(s) in the following academic year, the result for the module being entered as a failed element (FE), or the candidate may be requested to carry out further work at the discretion of the programme board. A mark of less than 35% for the Final Theory element will be entered as a failed element (FE) and will necessitate that the candidate takes a repeat examination at the next available sitting.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 60 % | | |
|--|---------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Lecture CAs | 20 % | OnGoing | 1,2,3,4 |
| Assessment | Practical CAs | 40 % | OnGoing | 2,5,6 |

| End of Semester / Year Formal Exam: | | 40 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 40 % | End of Semester | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Lecture Theatre | 1 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 3 | Weekly |

Required Reading Book List

Allison, A., (2021). *Fundamental Molecular Biology*. John Wiley & Sons.
ISBN 9781119156291 ISBN-13 1119156297

Brown, T A., (2020). *Gene Cloning and DNA Analysis*. John Wiley & Sons.
ISBN 9781119640783 ISBN-13 1119640784

Literary Resources

Journal Resources

As directed by academic staff

Online Resources

As directed by academic staff

Other Resources

As directed by academic staff

Programme Membership

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Microbiology 2 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module predominantly focuses on applications associated with microorganisms. The module provides an overview of commercial products manufactured using microorganisms. Environmental applications of microorganisms will also be studied, and fungal and viral culturing/enumeration methods will be performed as part of laboratory practical sessions. Microbial genetic transfer systems will also be investigated.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Perform membrane filtration on a water sample to test for the presence of an indicator microorganism.
2. Discuss the importance of bacterial taxonomy and the multiple methods used for identification and description of new species.
3. Generate a growth curve using a bacterial batch culture to assess the different stages of bacterial growth.
4. Discuss industrial applications associated with the use of microorganisms.
5. Determine viral titres using bacteriophage and appropriate host cells.
6. Successfully culture moulds using appropriate media types and visualise using a stereoscopic microscope.
7. Describe the different methods of genetic transfer used by bacterial cells.

Indicative Syllabus

Commercial Products and Biotechnology

- Industrial products and the microorganisms that make them.
- Biotechnology and enzymes, drugs & other chemicals.
- Alcoholic Beverages & Biofuels.
- Products from genetically engineered microorganisms.

Virology

- Virus structure and growth, Viral replication and Viral diversity.
- Culture and Titre Determination of Bacteriophage.

Mycology

- Fungal Structure & Symbioses.
- Mould Culture, Staining & Observation.
- Fungal Reproduction & Phylogeny.

Genetics of Bacteria & Archaea

- Mutation, Gene Transfer, Genetic Recombination, Transformation, Transduction & Conjugation.

Microbial Systematics

- Classification and Nomenclature. Phenotypic, Genotypic and Phylogenetic analyses used for identification and description of new species.

Wastewater treatment, Water Purification, Waterborne Microbial Diseases & Water Testing

- Wastewater Microbiology and Water Purification.
- Waterborne Microbial Diseases.
- Water Testing Techniques and Indicator Organisms.
- Water Standards & Directives.

Teaching and Learning Strategy

The Microbiology module will encompass student-centred presentations, interactive videos, tutorials & practical laboratory activities. The module will also host real-time formative assessment using online quiz applications to assess student performance and facilitate the provision of feedback. Interactive platforms will also be used to assess prior knowledge of students.

Assessment Strategy

Module assessment incorporates a continuous assessment component which pertains to laboratory write-up/assessment along with continuous theory-based assessment. There is also a formal end-of-year examination. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat formal end-of-semester examinations are set for repeat students. Repeat theory CA exams will be offered, and repeat practical exams may be offered depending on the circumstances associated with the failure of this element. Repeat assessments will be in line with GMIT Academic Code of Practice No 3 - Student Assessment: Marks & Standards.

Additional Facilities**Indicative Coursework and Continuous Assessment:**

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|----------------|--|----------------|--------------------------|--------------------------|
| Open Book Exam | Online quizzes | 20 % | OnGoing | 1,2,3,4 |
| Lab Report | Laboratory Practical Write-Up and Online Quizzes | 30 % | OnGoing | 1,3,5,6 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|-------------|-------------------------------------|----------------|--------------------------|--------------------------|
| Assessment | Formal End of Semester Examinations | 50 % | End of Semester | 2,4,5,7 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|-----------------------|--------------------|--------------|------------------|
| Lecture | Lecture and Tutorials | Lecture Theatre | 3 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 1.5 | Weekly |

Required Reading Book List

, B., (2017). *Microbiology*.
ISBN 1119390109 ISBN-13 9781119390107

Willey, M., (2019). *Prescott's Microbiology*.
ISBN 1260211886 ISBN-13 9781260211887

Madigan, T., Bender, S., Buckley, H., Sattley, W., Stahl, A., (2018). *Brock biology of microorganisms*. Pearson Higher Education.
ISBN 1292235101 ISBN-13 9781292235103

Literary Resources**Journal Resources**

Applied Microbiology and Biotechnology

Online Resources

Links will be provided on an ongoing basis.

Other Resources

Laboratory materials. This will be communicated to students upon initiation of the course.

Programme Membership

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Instrumentation 2.1 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 06 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module assists the learner to acquire the following skills:

- How to calibrate and operate scientific and industrial instruments efficiently and safely, and
- How to assess instruments as to suitability and performance for stated tasks.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain the mode of operation of key sensors and transducers and implement appropriate calibration and signal conditioning. Measure, record and analyse data with a range of sensors and transducers.
2. Analyse and construct simple electrical circuits, execute meaningful measurements in a safe and proper manner, and carry out basic trouble-shooting with electronic equipment.
3. Choose the optimum sensors and/or instruments for specific measurements. Make sensible decisions on the purchase of scientific equipment to meet requirements.
4. Use a range of basic electronic test and measurement equipment including meters, oscilloscopes, function generators, timer counters etc. and optimise instrument settings in performing measurements.
5. Act without direct supervision in carrying out and interpreting routine measurements on parameters such as temperature, pressure, salinity, pH, conductivity etc. Collect and analyse data from automated recording instruments.

Indicative Syllabus

Electrical safety: Sources of hazard. Physiological effects of electricity. Safe practices. Electrical Circuits: Circuit description. Methods of analysis: Ohm's law, Kirchhoff's laws, Voltage-Ratio Theorem, Thevenin's Theorem. Power transfer. Input and Output impedances.

Instrument Calibration: Primary and secondary reference standards. Laboratory accreditation and quality assurance. Traceability. Uncertainty in measurement.

Instrument classification: Analogue vs. digital. Active/passive. Null methods. Feedback and control. Measuring instrument performance: Range, accuracy and tolerance, precision, linearity, sensitivity, resolution, repeatability/reproducibility. Selectivity.

Sensors And Transducers: General principles. Characteristic equations. Types of temperature sensors/devices - platinum resistance, thermistor, thermoelectric, radiative and their performance characteristics.

Analytical instrumentation: Interference, diffraction, interferometers, X-ray diffraction and spectroscopy.

Data logging: Use of data loggers in the field and the laboratory, the use of computers as a method of collecting, presenting and processing data, file handling and analysis.

Teaching and Learning Strategy

Theory addressed via traditional lecture and tutorial classes. Practical skills taught through lecture-structured practical instruction sheets.

Assessment Strategy

Theory is assessed by in-class written assessments, on-line quizzes and a terminal exam. The terminal exam is a must pass element. Practical skills are assessed by weekly marking of the student's practical write-up, formal practical exams and problem-based learning group projects. The practical element of the module is a must pass element.

Repeat Assessment Strategies

Terminal theory paper repeat is offered in autumn.

Practical skills can only be repeated by repeat attending the module.

Additional Facilities**Indicative Coursework and Continuous Assessment:****60 %**

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|-------------------|--|----------------|--------------------------|--------------------------|
| Assessment | Class Assessment Assignments/Assessments/Theory quizzes | 10 % | OnGoing | 1,2,3 |
| Skills Evaluation | Class Assessment Practical work/Reports | 30 % | OnGoing | 1,2,4,5 |
| Skills Evaluation | Practical Evaluation Practical Assessments | 20 % | OnGoing | 1,2,4,5 |

End of Semester / Year Formal Exam:**40 %**

| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
|------------------|--------------------------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam Written examination | 40 % | End of Semester | 1,2,3 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|--------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Bolton, W., *Instrumentation and Process Measurements*. Longman Publishing Group.
ISBN 0582068088 ISBN-13 9780582068087

Bolton, W., (2021). *Instrumentation and Control Systems*. Newnes.
ISBN 9780128234716 ISBN-13 0128234717

Literary Resources

Measurement & Instrumentation Principles, A. S. Morris, 2001, Elsevier Butterworth Heinemann. ISBN 0 7506 5081 8

Journal Resources**Online Resources**

Moodle page for this Module

Other Resources

Electronic Test Instruments Analog and Digital Measurements, Robert A. Witte, 2002, Prentice Hall, ISBN 0-13-066830-3

Analytical Instrumentation: Performance Characteristics and Quality, Graham Currell, 2000, Wiley

Programme Membership



GMIT07016 2024 Six Sigma for Quality Management

Elective Delivered in Stage 2 Semester 4

| | | | |
|----------------------|----------------------------------|-----------------------|-----------------------|
| Full Title | Six Sigma for Quality Management | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module covers the relevant Six Sigma tools and their application to Practitioners of Quality Management (Quality Technicians, Quality Engineers, and Quality Managers etc). It will connect the use of Six Sigma tools and techniques with traditional Quality Management tools, for example, the use of DMAIC or the Structured Problem Process in the CAPA process. It will give the student statistical tools that are required for data analysis and problem solving. It also describes how Six Sigma and Quality Management both strive for Continuous Improvement.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|---|
| 1. | Describe the role of Six Sigma as part of an organization's quality management system |
| 2. | Perform various analyses such as DMAIC and Structured Problem Solving. |
| 3. | Identify and apply relevant quality tools to manufacturing issues, such tools to include cycle time reduction, risk analysis, kaizen and waste elimination. |
| 4. | Apply probability and statistical rules and concepts. |
| 5. | Develop plans for continuous improvement |

Indicative Syllabus

How to apply Six Sigma to Quality Management
 Structured Problem Solving – 6 Step Problem Solving Training
 DMAIC – Define, Measure, Analyse, Improve and Control, applying the relevant sections to Quality applications.
 Application of Statistical quality tools and techniques
 Continuous Improvement including Lean Manufacturing

Teaching and Learning Strategy

Flexible delivery including face to face, online or a combined blended methodology. Learning will be facilitated through group work, discussions, debate and peer learning. The support of technology will enhance this learning approach. When deploying the blended approach, a combination of face to face and online teaching will take into consideration the context of the topic, as well as alignment with other modules being delivered at the time.

Assessment Strategy

Mixture of project-based assignments, case studies and other assessments.

Repeat Assessment Strategies

Repeat assessment available

Additional Facilities

| | | | | |
|---|--------------|----------------|--------------------------|--------------------------|
| Indicative Coursework and Continuous Assessment: | | 100 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |

| | | | | |
|------------|------------|-------|-----------------|-----------|
| Assessment | Assessment | 100 % | End of Semester | 1,2,3,4,5 |
|------------|------------|-------|-----------------|-----------|

| Full Time Delivery Mode: | | | | |
|---------------------------------|--------------------|-----------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Not Specified | 3 | Weekly |

| Online Learning Delivery Mode: | | | | |
|---------------------------------------|--------------------|-----------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Not Specified | 3 | Weekly |

| Required Reading Book List | | | | |
|--|--|--|--|--|
| Harrington, H., Voehl, F., (2009). <i>The Six Sigma Yellow Belt Handbook</i> . ISBN 1932828249 ISBN-13 9781932828245 | | | | |
| George, M., (2002). <i>Lean Six Sigma</i> . McGraw-Hill. ISBN 0071385215 ISBN-13 9780071385213 | | | | |
| George, M., Maxey, J., Rowlands, D., Upton, M., (2004). <i>The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to 70 Tools for Improving Quality and Speed : A Quick Reference Guide to 70 Tools for Improving Quality and Speed</i> . McGraw Hill Professional. ISBN 0071441190 ISBN-13 9780071441193 | | | | |
| Jones, E., (2014). <i>Quality Management for Organizations Using Lean Six Sigma Techniques</i> . CRC Press. ISBN 9781482246995 ISBN-13 1482246996 | | | | |

| Literary Resources |
|---------------------------|
| |

| Journal Resources |
|--------------------------|
| |

| Online Resources |
|-------------------------|
| ASQ.org |

| Other Resources |
|------------------------|
| |

| Programme Membership |
|-----------------------------|
| |



Stage 3 Modules

| | | | |
|----------------------|-------------------------------------|-----------------------|-----------------------|
| Full Title | Bioanalytical Techniques L7 Theory. | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Paul Walsh | | |
| Co Authors | Sharon Barrett, Macdara Bodeker | | |

Module Description

This module aims to provide students with a broad knowledge of the theory, practice and interpretation of the various pharmacopoeia tests and instrumentation routinely employed in a Biopharmaceutical Quality Control laboratory to assess the quality of raw materials, intermediate and finished-goods product.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Interpret the European Pharmacopoeia and US Pharmacopoeia for QC Testing.
2. Outline and evaluate the basic test methods routinely employed in the analysis of pharmaceutical and biopharmaceutical products.
3. Describe the typical analytical equipment employed for performance of the analytical test methods.
4. Describe the basic principles of Lean Manufacturing as related to laboratory practices.
5. Analyse and draw conclusions from typical quantitative and qualitative data obtained in an analytical laboratory and/or data presented in problem solving exercises.

Indicative Syllabus

The following is a summary indication of the main topics included in this module:

Introduction to GLP. GMP and ISO 17025.

The principles and applications of the following bioanalytical technologies:

- pH calibration and measurements.
- Conductivity measurements.
- Melting point.
- Osmolality measurements.
- Titrations.
- Loss on drying.
- Residue on Ignition.
- Heavy Metals tests.
- Optical rotation.
- Particle size analysis.
- Viscosity.
- Relative density.
- HPLC – Principles and Applications.
- Protein Electrophoresis.
- Immunoassays and protein assays.
- Introduction to PCR.
- Bioburden analysis

Teaching and Learning Strategy

This module will be delivered fulltime. Moodle will be used as a repository of educational resources and as a means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

This module is 50% Continuous Assessment and 50% Final exam'. There will be 2 MCQs given during the semester, one mid semester and the second at the end of the semester. An online Long Answer Question Paper will take place towards the end of the semester.

| | | | | |
|--|---------------------------|-------------------------|--------------------------|--------------------------|
| Repeat Assessment Strategies | | | | |
| Repeat exam or repeat continuous assessment. | | | | |
| Additional Facilities | | | | |
| Online teaching technologies. | | | | |
| Indicative Coursework and Continuous Assessment: | | 50 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | Week 6 | 1,2,3,4 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | Week 11 | 1,2,3,5 |
| Assessment | LAQ | 20 % | Week 14 | 3,5 |
| End of Semester / Year Formal Exam: | | 50 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | End of Semester | 1,2,3,4,5 |
| Part Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Online lecture. | Distance Learning Suite | 1 | Weekly |
| Directed Learning | Directed self-study. | Not Specified | 4 | Weekly |
| Literary Resources | | | | |
| Protein Biochemistry and proteomics: Publisher: Elsevier ISBN: 978-0-12-088545-9. | | | | |
| Pharmaceutical Biotechnology: An Introduction for Pharmacists and Pharmaceutical Scientists, 2nd Edition. J. Daan and R. Sindelar. Publisher: Taylor and Francis. ISBN: 0415285003. | | | | |
| Journal Resources | | | | |
| N/A | | | | |
| Online Resources | | | | |
| www.fda.gov www.usp.org www.ich.org | | | | |
| Other Resources | | | | |
| None | | | | |
| Programme Membership | | | | |
| SG_SBIOP_J07 201900 Bachelor of Science in Biopharmaceutical Science (Add-on) SG_SBIOM_H08 202000 Bachelor of Science (Honours) in Biomedical and BioIndustrial Sciences SG_SAPMS_H08 202000 Bachelor of Science (Honours) in Applied Medical Sciences | | | | |



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BIO07022 2019 PROTEIN BIOTECHNOLOGY

Elective Delivered in Stage 3 Semester 5

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|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | PROTEIN BIOTECHNOLOGY | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Macdara Bodeker | | |

Module Description

This module aims to study the structure and function of proteins in greater depth than the basics covered in a Biochemistry module. Protein primary, secondary, tertiary and quaternary structure will be examined using non traditional methods.. There is a heavy emphasis on using bioinformatics and data mining technologies to gain an understanding of protein design and genetic manipulation.

Learning Outcomes

On completion of this module the learner will/should be able to:

- List and explain the major bond types which accompany peptide and protein formation and understand what conditions need to be maintained to preserve their structure.
- Illustrate and distinguish between the main secondary, tertiary and quaternary structures which are formed during protein synthesis and also the role and significance of post translational modifications.
- Examine the key functions of proteins in cells and tissues and the characterize the role of proteins in human disease.
- Demonstrate an ability to search and compare DNA and protein sequences and structures from sequencing databases using data mining techniques.
- Demonstrate an ability to write industry standard reports with particular emphasis on effective referencing and prioritisation/selection of relevant material.

Indicative Syllabus

Protein Structures

Protein bonding

Structural Domains

Protein adverse reactions

Post-translational modification

Protein Functions and protein as drugs

Proteins and Disease

Protein Modelling

Teaching and Learning Strategy

'This module will be delivered fulltime. This will include lectures and computer laboratory practicals augmented by independent learning and directed learning. This approach is expected to address student learning needs. Moodle will be used as a repository of educational resources and as a means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

This module is 100% Continuous Assessment. There will be 3 number of MCQs given during the semester every four weeks. A written summary of a chosen peer reviewed article on protein will be submitted at the end of the semester. A project on a specific recombinant protein is submitted at the end of the semester which

demonstrates the student's ability to critically evaluate an aspect of recombinant protein design and production.

Repeat Assessment Strategies

Repeat Continuous Assessment and/or project resubmission.

Additional Facilities

none

| Indicative Coursework and Continuous Assessment: | | 0 % | | |
|--|--|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Theory quizzes. | 45 % | Any | 1,2,3 |
| Group Project | Group Project Group \Discussion of Protein Relevant Topics | - % | Any | 1,2,3,4,5 |
| Written Report/Essay | Literature Survey | 15 % | End of Semester | 4,5 |
| Written Report/Essay | Individual Project Topical Individual Research | 40 % | End of Semester | 1,2,3,4,5 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------|------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Independent Learning | Self Study | Not Specified | 5 | Weekly |

Required Reading Book List

Lesk, M., (2016). *Introduction to Protein Science*. Oxford University Press, USA.
ISBN 0198716842 ISBN-13 9780198716846

Literary Resources

Introduction to protein science: Architecture, function and genomics. Arthur M.Lesk. Oxford University Press 1st ed. 2004

Protein Biochemistry and Proteomics, Hubert Rehm. Oxford University Press 2006

Journal Resources

none

Online Resources

www.ncbi.nlm.nih.gov

www.ebi.ac.uk

Other Resources

Moodle lecture series

The Theoretical and Computational Biophysics Group (TCBG), an NIH Resource for Macromolecular Modeling and Bioinformatics: <http://www.ks.uiuc.edu/>

Medline protein/peptide databases

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science

SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology

SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Animal Cell Culture | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Tony McCabe | | |

Module Description

The animal cell culture module introduces the basic concepts and issues pertaining to the culture of animal cells. The module begins with a historical and applications-driven view of the topic and the types of cells which are cultured *in vitro*. The module outlines the growth requirements of cells in culture including the various media which may be used and how cells are grown and stored by cryopreservation. Issues relating to chemical and biological contaminations which may impact on cell culture are described. The regulations pertaining to genetically modified organisms which are pertinent to the biopharmaceutical industry are discussed. The module includes a comprehensive laboratory element introducing basic cell culture preparation, growth, storage and analysis of cell culture.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain, using appropriate technical terminology, what is meant by animal cell culture and outline the key applications.
2. Describe the growth requirements and characteristics of cells in culture.
3. Outline the various growth platforms which may be used in cell culture.
4. Explain, illustrate and/or demonstrate how to establish, passage, freeze, recover and maintain selected cell lines.
5. Recognise and evaluate the QC issues and GMP requirements pertinent to cell culture laboratories.
6. Evaluate contamination and biosafety issues.
7. Execute laboratory protocols which are used in routine animal cell culture.
8. Analyse and report experimental concepts and data.

Indicative Syllabus

Explain, using appropriate technical terminology, what is meant by cell culture and outline the key applications.

Cell culture history and current uses.

Describe the growth requirements and characteristics of cells in culture.

How cells are obtained. Types and constituents of cell culture media.

Outline the various growth platforms which may be used in cell culture.

Culture vessels and formats for culture growth.

Explain, illustrate and/or demonstrate how to establish, passage, freeze, recover and maintain selected cell lines.

Growth characteristics and cell passaging. Cryopreservation of cells.

Recognise and evaluate the QC issues and GMP requirements pertinent to cell culture laboratories.

Biological safety cabinets, master cell stocks and sources, contamination and consequences. Use of antibiotics and sterility assurance of cell culture.

Evaluate contamination and biosafety issues.

Biological and chemical contaminant types, identification, prevention and treatments. GMO regulations.

Execute laboratory protocols which are used in routine animal cell culture.

Standard procedures necessary for the growth, storage and recovery of cells in culture.

Analyse and report experimental concepts and data.

Presentation of data through elements such as abstracts, introductions and discussions, encompassing elements of graph, image and data tables

Teaching and Learning Strategy

The module contact time will be split evenly between lectures and laboratory time.

Contact time will contain some tutorial elements which will be used to help students address problem topics and answer questions and provide feedback on assessments.

Lectures can comprise of elements such as: Powerpoint presentations, videos, articles for study and discussion on relevant topics.

The moodle platform will be used to as a repository for course material.

Active Learning:

Students will be asked to read around and contextualize relevant articles and topics.

Students will be required to research relevant information for the production of experimental reports.

Tutorials:

Occasional time will be set aside for tutorials will allow time for students to discuss the quizzes and assessments in a face to face or class format during which problems can be addressed and additional explanations provided.

Small group writing tutorials will be provided for students who require additional help in constructing elements of reports (for example data presentation).

Laboratory work:

Students will execute relevant experimental procedures within groups. When possible, students also work individually in the laboratory on certain experiments.

The laboratory classes are preceded by introductory lectures, so students are aware of the research question at hand, requirements, learning outcomes and any relevant health and safety concerns.

Students are encouraged to raise learning issues, particularly with new techniques.

Assessment Strategy

This module has an end of semester exam worth 50% and a laboratory element worth 50%.

The students' performance will be evaluated through formative and summative assessments.

Formative assessment:

The formative assessments may be delivered in class and through online quizzes so students can check their own progress. Assessments will be provided on an on-going basis throughout the semester and can be taken at a time of the students' choosing. Typically, they will be made available at the end of particular topics during the module. Online quizzes and review questions and crosswords are provided on the moodle platform, students can access these resources at any time once made available.

Quizzes will be designed in accordance to Bloom's taxonomy, assessing elements relevant to the level 7 module status.

Summative assessment:

Module theory will be assessed through an end of semester exam worth 50% of the module. Relevant elements of the module theory, pertaining to testing for example, will also be assessed during practical evaluation, entailing short quizzes on the practical applications of the module. The laboratory element of the module (50%) will undergo a Practical Evaluation over the semester. This evaluation will assess students' basic laboratory skills and professional attitude, the students' data presentation and analysis skills as well as their dissemination skills through submission of reports or individual report elements such as abstracts.

Remote proctoring of exams may be required, particularly for overseas students.

The moodle platform will be used by students to upload assignments and will be used in combination with Turnitin software.

The student must reach an assigned mark in the final exam and achieve 40% overall to pass the module. The student must attend a minimum of 75% in the laboratory element of the module or they may be required to repeat and re-attend the module.

Repeat Assessment Strategies

If a student fails to achieve 40% in the module they will be required to resit the exam, resubmit or submit laboratory reports, write a theory assignment or a combination of these.

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|---|-----------------|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Quiz | - % | OnGoing | 1,2,3,4,5,6 |
| Practical Evaluation | Laboratory work | 50 % | OnGoing | 2,3,4,7,8 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|--|--------------|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final exam | 50 % | End of Semester | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|---------------------------------|-------------------------------|--------------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |
| Lecture | Theory delivery and tutorials | Lecture Theatre | 3 | Weekly |
| Independent Learning | self study | Not Specified | 8 | Weekly |

Recommended Reading Book List

Freshney, R., (2000). *Culture of Animal Cells*. Wiley-Liss.
ISBN 0471348899 ISBN-13 9780471348894

Literary Resources

Freshney, R.I, 4th Edition; "*Culture of Animal Cells: A Manual of Basic Techniques*."
Davis, J.M: "*Basic Cell Culture- A Practical Approach*"
Darling, D.C & Morgan S.J: "*Animal Cells- Culture and Media*".
Rebecca Skloot: *The Immortal Life of Henrietta Lacks*

Journal Resources

Specific articles will be suggested to the students rather than journals.

Online Resources

https://www.atcc.org/~media/pdfs/culture%20guides/animcellculture_guide.ashx
<https://www.sigmaaldrich.com/technical-documents/protocols/biology/basic-techniques.html>
https://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma-Aldrich/General_Information/1/fundamental-techniques-in-cell-culture.pdf
<https://www.coming.com/worldwide/en/products/life-sciences/resources/webforms/cell-culture-contamination-guide.html>
<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/bes2.1258>
www.Pubmed.com
www.Sciencedirect.com

Other Resources

<https://www.mendeley.com/guides/harvard-citation-guide>

Podcasts:

<https://cellculturedish.podbean.com/>
<https://www.talkingbiotechpodcast.com/>
<https://speaking-sciencepodcast.com/page/2/>

Videos:

https://www.youtube.com/watch?v=C0IMrp_ySg8

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|---------------------------|-----------------------|-----------------------|
| Full Title | STATISTICS FOR SCIENTISTS | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Padraig McGourty | | |

Module Description

This course is designed to provide an introduction to a range of statistical tools of relevance to scientists. Specific topics include an overview of statistical distributions, significance testing, uncertainty determination, linear regression and experimental design. The application of statistics for quality control and practical experience in the application of statistical features in the widely available Microsoft Excel is particularly emphasised.

The teaching methods used will be a combination of lectures, self-study, labs, tutorials, and any combination of discussion, case study, problem-solving exercises and computer-based learning.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe basic statistical terms which are of relevance to the area of analytical science.
2. Graphically display and numerically summarise data using appropriate tables, graphs and measures of centre, spread and position.
3. Explain and apply concepts of basic probability including, conditional probability, Bayes' theorem, independent events and counting formulae;
4. Make interferences about population parameters using sample statistics using confidence interval estimates and tests of statistical hypotheses
5. Describe the application of statistics to sampling, quality control, analytical method validation and experimental design.
6. Use an appropriate method for analysing relationships between variables in a dataset

Indicative Syllabus

1. Describe basic statistical terms which are of relevance to the area of analytical science

- Introduction to Statistical Terms
- Populations and Samples
- Data Types
- Introduction to Sampling Methods

2. Graphically display and numerically summarise data using appropriate tables, graphs and measures of centre, spread and position.

- Graphical Representation of data including frequency tables and charts
- Measures of Central Tendency, Position and Dispersion.

3. Explain and apply concepts of basic probability including, conditional probability, Bayes' theorem, independent events and counting formulae;

- Probability Experiments
- Probability Trees
- Classical Probability
- Experimental Probability
- Addition and Multiplication Rules of Probability
- Counting Rules
- Bayes Theorem
- Discrete Probability Distributions
 - Binomial Distribution
 - Poisson Distribution
- The Normal Distribution
 - Applications of the standard Normal Distribution
 - Assessing Normality
 - The Central Limit Theorem

4. Make interferences about population parameters using sample statistics using confidence interval estimates and tests of statistical hypotheses

- Introduction to Hypothesis Testing
- Writing hypotheses for statistical tests
- One Sample, Independent Samples and Paired Samples t-tests

- One-Way ANOVA and related Post Hoc Tests
- Repeated Measures ANOVA and related Post Hoc Tests
- z-tests for proportion size

5. Describe the application of statistics to sampling, quality control, analytical method validation and experimental design

- Sample Size Calculations
- Quality of Analytical Measurements
- Uncertainty
- Method Validation.
- Calibration Methods
- Experimental Design and Optimisation

6. Use an appropriate method for analysing relationships between variables in a dataset

- Relationship Modelling
- Pearson's Correlation Co-efficient
- Significance of the correlation co-efficient
- Simple Linear Regression
- Chi Square test for association
- Chi Square test of goodness of fit

During the Practical element of the course, students will use the Data Analysis ToolPak in Microsoft Excel to carry out the various types of analysis listed in the syllabus above.

Teaching and Learning Strategy

The teaching methods used will be a combination of lectures, self-study, labs, tutorials, and any combination of discussion, case study, problem-solving exercises and computer-based learning.

The practical element of the course will be delivered separately to students in their various class groups (Biomedical Science/Medical Biotechnology, Forensic Science, Pharmaceutical Science) so that the examples used in the practical application of statistics can be tailored to their field of study.

Assessment Strategy

This module will be assessed by both summative and formative means. The student will be assessed by means of both summative and formative assessment. The summative assessment will consist of continuous assessments where the student will be examined on both their theoretical knowledge of statistics and their use of statistical analysis software to apply this knowledge with the emphasis on the practical application of statistics. They will also take an end of module exam which will concentrate further on their knowledge of the application of statistics to scientific related problems and in the area of experimental design.

The formative assessment will be by means of a number of self assessment quizzes which the student can attempt in order to track their progress on the module and identify any gaps they may have or areas that they need further clarification in.

Repeat Assessment Strategies

Where the student fails to achieve the pass mark in the module, they may be asked to repeat the final exam or complete a practical laboratory assessment or a combination of both.

The repeat practical laboratory assessment will be held in the first week of September prior to the autumn exam boards taking place.

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Practical Evaluation | Descriptive Statistics - Practical Exam | 15 % | Week 5 | 2 |
| Practical Evaluation | Inferential Statistics - Practical Exam | 20 % | Week 13 | 4,5,6 |
| Multiple Choice/Short Answer Test | Theory Assessment | 15 % | Week 8 | 1,3,5 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | End of Term Exam | 50 % | End of Term | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|----------------------|---------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practical | Computer Laboratory | 1 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Recommended Reading Book List

Farrant, J., (2009). *Practical Statistics for the Analytical Scientist*. Royal Society of Chemistry. ISBN 9780854041312 ISBN-13 0854041311

Miller, J., (2017). *Statistics and Chemometrics for Analytical Chemistry*. ISBN 1292186712 ISBN-13 9781292186719

Dr, A., (2009). *Essential Mathematics and Statistics for Science*. Wiley.
ISBN 0470694483 ISBN-13 9780470694480

Lucy, D., (2005). *Introduction to Statistics for Forensic Scientists*. Wiley.
ISBN 0470022019 ISBN-13 9780470022016

Bluman, A., (2014). *Elementary Statistics*. McGraw-Hill Higher Education.
ISBN 9780077665807 ISBN-13 0077665805

Triola, F., (2016). *Elementary Statistics Using Excel*. Pearson.
ISBN 9780134429816 ISBN-13 0134429818

Literary Resources

N/A

Journal Resources

N/A

Online Resources

N/A

Other Resources

N/A

Programme Membership

SG_SPHAR_B07 201900 Bachelor of Science in Pharmaceutical Science with Drug Development
 SG_SPHAR_H08 201900 Bachelor of Science (Honours) in Pharmaceutical Science with Drug Development
 SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
 SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
 SG_SFORE_H08 201900 Bachelor of Science (Honours) in Forensic Investigation and Analysis
 SG_SFORE_B07 201900 Bachelor of Science in Science in Forensic Investigation and Analysis
 SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science



PHRM07008 2019
Pharmaceutical Processing and Medical Device
Manufacture

Elective Delivered in Stage 3 Semester 5

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Pharmaceutical Processing and Medical Device Manufacture | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Tom Patton | | |
| Co Authors | Declan Shelly | | |

Module Description

This module details the diverse array of manufacturing processes & equipment employed in the pharmaceutical industry, in combination with the product packaging techniques. Additionally it provide the student with a broad understanding of the various types of medical devices available and the modes and methods of manufacture.

Learning Outcomes

On completion of this module the learner will/should be able to:

- To detail the mainstream systems and equipment used for generation of EP and USP grade water for Pharm/Biopharma production and manufacture.
- To demonstrate a knowledge of the various information technology applications operating in the pharmaceutical industry.
- To distinguish how non sterile Pharma/cosmetic products are manufactured, processed and the packaging options/requirements suited to each type of formulation.
- To describe the methods to ensure the sterility of pharmaceutical preparation to the point of primary container closure selection and processing.
- Contrast solid dosage form production techniques, from dry powder mixing to finished dosage formation and the packaging methods and requirements.
- Demonstrate a knowledge and understanding of the medical device industry and the main product types currently being manufactured.

Indicative Syllabus

To detail the mainstream systems and equipment used for generation of EP and USP grade water for Pharm/Biopharma production and manufacture .

Purified Water systems -Organic Scavenger, Twin bed Deioniser, UF, RO, CDI, TCS, Ozonation, UV. Filtration, Carbon, depth, mixed membrane. Cleaning systems, Detergents, CIP, SIP, sanitation.

To demonstrate a knowledge of the various information technology applications operating in the pharmaceutical industry.

Computerised system control. - Scada, PLCs, EBMR, ERP.

Batch Records - documentation, labelling (RFID), dispensing, LAF.

To distinguish how non sterile Pharma/cosmetic products are manufactured, processed and the packaging options/requirements suited to each type of formulation.

Non sterile - Ingredients, Creams, gels, liquids (suspensions, emulsions), mixing, milling, filling (tubes plastic, alu, bottles glass, plastic, sachet), packaging.

To appraise the cleaning requirements of process equipment and methods employed by industry to combat this requirement.

Contrast solid dosage form production techniques, from dry powder mixing to finished dosage formation and the packaging methods and requirements.

Solid dosage form - Tableting – Ingredients, mixing, granulation, compression, coating, blister packs.

To describe the methods to ensure the sterility of pharmaceutical preparation to the point of primary container closure selection and processing.

Sterile Liquids , Parenterals - Formulation, Sterile manufacture, filtration, filling, packaging BFS, Terminal sterilization, ETO.

Biologics - Fermentation, scale up, harvesting, disruption, filtration, filling, lyophilization, packaging Vials.

Demonstrate a knowledge and understanding of the medical device industry and the main product types currently being manufactured.

Introduction to Medical Device Manufacturing. Medical Device Classification and Certification.

Typical Medical Devices and their Manufacturing Steps. Other support services for the manufacturing of Medical Devices.

Teaching and Learning Strategy

This module will be delivered full time. This will include lectures, augmented by independent learning and directed learning. This approach is expected to address student learning needs. Moodle will be used as a repository of educational resources and as a potential means of assessment (e.g. quizzes, uploading assignments and journals).

| Assessment Strategy |
|--|
| This module will be assessed using a combination of end of semester final exam (60%), continuous assessment and course work (40%). |
| The continuous assessment and course work will involve Short Answer Questions/Multiple Choice Questions/Assignment Work where students will be required to (i) demonstrate an understanding of core module concepts, and (ii) presentations on topics which demonstrates the student's ability to critically evaluate an aspect of the subject area. |

| Repeat Assessment Strategies |
|---|
| Repeat Continuous Assessment and/or Final Exam. |

| Additional Facilities |
|---|
| Laboratories, Flat classrooms, Final examination centres. |

| Indicative Coursework and Continuous Assessment: | | 40 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Group Project | Presentation on processing technology | 10 % | OnGoing | 3,4,5 |
| Assignment | Assignment Short Answer Questions/Multiple Choice Questions/Assignment Work | 30 % | OnGoing | 1,2,3,4,5,6 |

| End of Semester / Year Formal Exam: | | 60 % | | |
|-------------------------------------|-----------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam End of term exam | 60 % | End of Term | 1,2,3,4,5,6 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------|---------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Not Specified | 3 | Weekly |
| Independent Learning | Self study | UNKNOWN | 4 | Weekly |

| Recommended Reading Book List |
|---|
| Swarbrick, J., (2013). <i>Encyclopedia of Pharmaceutical Science and Technology, Fourth Edition, Six Volume Set (Print)</i> . CRC Press. ISBN 1841848190 ISBN-13 9781841848198 |
| Michael, K., (2013). <i>Aulton's Pharmaceutics</i> . Elsevier Health Sciences. ISBN 9780702042904 ISBN-13 0702042900 |
| Allen, L., (2017). <i>Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems</i> . LWW. ISBN 1496347285 ISBN-13 9781496347282 |
| Walsh, G., (2007). <i>Pharmaceutical Biotechnology</i> . John Wiley & Sons. ISBN 9780470012444 ISBN-13 0470012447 |
| , C., <i>Pharmaceutical Production Facilities</i> . Taylor & Francis. ISBN 9780748404384 ISBN-13 0748404384 |
| Baura, G., (2011). <i>Medical Device Technologies</i> . Academic Press. ISBN 9780080961125 ISBN-13 0080961126 |

| Literary Resources |
|--------------------|
| N/A |

| Journal Resources |
|-------------------|
| None. |

| Online Resources |
|---|
| https://ec.europa.eu/health/documents/eudralex/vol-4_en |
| https://www.ich.org/home.html |
| http://www.pharmtech.com/pharmtech-europe-0 |
| https://ispe.org/initiatives/europe |

| Other Resources |
|-----------------|
| None |

| Programme Membership |
|----------------------|
| |

SG_SPHAR_B07 201900 Bachelor of Science in Pharmaceutical Science with Drug Development
SG_SPHAR_H08 201900 Bachelor of Science (Honours) in Pharmaceutical Science with Drug Development

| | | | |
|----------------------|--------------------|-----------------------|-----------------------|
| Full Title | Immunodiagnosics | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Tony McCabe | | |

Module Description

The immunodiagnosics module introduces students to the application of antibodies for the purpose of diagnosis. The structures of antibodies and antigens are introduced and the different classifications of antibodies (such as mono- or polyclonal) and their relevance are discussed. Tissue type and sampling in immunodiagnostic testing is outlined along with antibody conjugation, types of output, signal detection, dynamic range and signal amplification. Antibody validation is addressed in relation to titrating, specificity and sensitivity issues for testing. Common applications, assay types and future applications are also discussed.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Define immunodiagnosics and relate the structure, biochemistry and production of Immunoglobulins and antigens to testing.
2. Describe the methods of antibody conjugation, signal outputs, signal amplification and patient sampling commonly used in immunodiagnostic testing.
3. Recognise and evaluate the QC issues pertinent to immunodiagnostic techniques and the interplay between dynamic range, sensitivity and specificity.
4. Identify applications of immunodiagnosics and detail current and future applications.
5. Demonstrate key immunodiagnostic concepts and execute common laboratory assays, which are used in immunodiagnosics.
6. Analyse and report experimental concepts and data.

Indicative Syllabus

Define immunodiagnosics and relate the structure, biochemistry and production of Immunoglobulins and antigens to testing.

Antigen and antibody types. Antibody production.

Describe the methods of antibody conjugation, signal outputs, signal amplification and patient sampling commonly used in immunodiagnostic testing.

Bioconjugation. Signal outputs and amplification. Tissues used in testing.

Recognise and evaluate the QC issues pertinent to immunodiagnostic techniques and the interplay between dynamic range, sensitivity and specificity.

Antibody affinity specificity, sensitivity and dynamic range.

Identify applications of immunodiagnosics and detail current and future applications.

Common applications such as ELISA, immunohistochemistry and immunocytology.

Quantum dots, aptamers and multianalyte testing.

Demonstrate key immunodiagnostic concepts and execute common laboratory assays, which are used in immunodiagnosics.

Antibody titration, blocking and detection. Common assays such as ELISA, Dot blot and western blotting.

Analyse and report experimental concepts and data.

Presentation of data through elements such as abstracts, introductions and discussions, encompassing elements of graph, image and data tables.

Teaching and Learning Strategy

The module contact time will be split evenly between lectures and laboratory time.

Contact time will contain some tutorial elements which will be used to help students address problem topics and answer questions and provide feedback on assessments.

Lectures can comprise of elements such as: Powerpoint presentations, videos, articles for study and discussion on relevant topics.

The moodle platform will be used as a repository for course material.

Active Learning:

Students will be asked to read around and contextualize relevant articles and topics.

Students will be required to research relevant information for the production of experimental reports.

Tutorials:

Occasional time will be set aside for tutorials will allow time for students to discuss the quizzes and assessments in a face to face format during which problems can be addressed and additional explanations provided.

Small group writing tutorials will be provided for students who require additional help in constructing elements of reports (for example data presentation).

Laboratory work:

Students will execute relevant experimental procedures within groups. When possible, students also work individually in the laboratory on certain experiments.

The laboratory classes are preceded by introductory lectures, so students are aware of the research question at hand, requirements, learning outcomes and any relevant health and safety concerns. Students are encouraged to raise learning issues, particularly with new techniques.

Assessment Strategy

This module has an end of semester exam worth 50% and a laboratory element worth 50%.

The students' performance will be evaluated through formative and summative assessments.

Formative assessment:

The formative assessments may be delivered in class and through online quizzes so students can check their own progress Assessments will be provided on an on-going basis throughout the semester and can be taken at a time of the students' choosing. Typically, they will be made available at the end of particular topics during the module. Online quizzes and review questions and crosswords are provided on the moodle platform, students can access these resources at any time once made available.

Quizzes will be designed in accordance to Bloom's taxonomy, assessing elements relevant to the level 7 module status.

Summative assessment:

Module theory will be assessed through an end of semester exam worth 50% of the module. Relevant elements of the module theory, pertaining to testing for example, will also be assessed during practical evaluation, entailing short quizzes on the practical applications of the module. The laboratory element of the module (50%) will undergo a Practical Evaluation over 4.5 weeks of the semester (or 26 hour equivalent). This evaluation will assess students' basic laboratory skills and professional attitude, the students' data presentation and analysis skills as well as their dissemination skills through submission of reports or individual report elements such as abstracts.

The moodle platform will be used by students to upload assignments and used in combination with Turnitin software.

Students, particularly those from overseas, can avail of remote proctoring of exams.

The student must reach an assigned mark in the final exam and achieve 40% overall to pass the module. The student must attend a minimum of 75% in the laboratory element of the module or they may be required to repeat and re-attend the module.

Repeat Assessment Strategies

If a student fails to achieve 40% in the module they will be required to resit the exam, resubmit or submit laboratory reports, write a theory assignment or a combination of these.

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|-----------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Quiz | - % | OnGoing | 1,2,3,4 |
| Practical Evaluation | Laboratory work | 50 % | OnGoing | 2,5,6 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam Theory Exam | 50 % | End of Semester | 1,2,3,4 |

| Full Time Delivery Mode: | | | | |
|--------------------------|-------------------------------|--------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Theory delivery and tutorials | Lecture Theatre | 2 | Weekly |
| Supervision | Laboratory work | Science Laboratory | 2 | Weekly |
| Independent Learning | Study | Not Specified | 3 | Weekly |

Recommended Reading Book List

Edwards, R., *Immunodiagnosics*. Oxford University Press, USA.
ISBN 0199635889 ISBN-13 9780199635887

Literary Resources

Edwards, R: "Immunodiagnosics– A Practical Approach".

The **Immunoassay** Handbook by David Wild **Ed.**: 4th ed. Oxford : Elsevier Science. 2013. Available as e-book through IT Sligo library.

Antibodies : Applications and New Development by Meulenber, Eline P. 2012. Available as e-book through IT Sligo library.

Journal Resources

Specific articles will be suggested to the students rather than journals.

Online Resources

<https://www.rndsystems.com/resources/articles>

<http://www.bio-rad.com/en-ie/category/antibodies?ID=N8TRV715>

<https://www.abcam.com/protocols/antibody-methods-and-techniques>

<http://www.ihcworld.com/>

www.biocompare.com

Other Resources

<https://www.mendeley.com/guides/harvard-citation-guide>

Webinars:

<https://www.cellsignal.com/contents/resources-videos-and-webinars/webinar-antibody-validation-roundtable-specificity-sensitivity-reproducibility-validation/webinars-avr-ssr-validation>

Moodle:

IT Sligo moodle page for module Immunodiagnosics.

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science

SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology

SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Legislation, Quality & Auditing Systems | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Tom Patton | | |
| Co Authors | James Murphy, Stephen Daly | | |

Module Description

This module introduces EMA/EU/Irish legislation for medicinal products. It also introduces Eudralex Volume 4, ICH, GMP, Auditing, relevant to the Pharma/Biomedical and Medical Device industry.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Demonstrate a detailed knowledge and understanding of the main US and EU institutions, legal instruments, ICH process and workings of EMA in relation to medicinal products.
2. Integrate knowledge and understanding of Common Technical Document (CTD), variations procedures and Clinical Trial Legislation to evaluate relevant case studies.
3. Source and evaluate guidance procedures and directives currently regulating good manufacturing practices (GMP).
4. Demonstrate knowledge of the ICH Q9 and Q10 guidance documents as relating to QRM and PQMS for a licensed production facility.
5. Interpret and understand the relevance of auditing as a means of monitoring the production of safe and efficacious pharmaceutical and medical device products in a GMP environment.
6. Source, interpret and apply GMP principles to different case scenarios and identify potential issues that would result in implementation of Corrective and Preventative Actions.

Indicative Syllabus

1 Demonstrate a detailed knowledge and understanding of the main US and EU institutions, legal instruments, ICH process and workings of EMA in relation to medicinal products.

History of Regulatory Affairs, Definitions, Regulatory framework, GMP.

Introduction to European and US legislation & terminology, Licenses required. Principal competent authorities Ireland/EU/USA.

2 Integrate knowledge and understanding of Common Technical Document (CTD), variations procedures and Clinical Trial Legislation to evaluate relevant case studies.

CTD & Clinical Trial Legislation, ICH guidance, Eudralex Vol. 2.

3 Source and evaluate guidance procedures and directives currently regulating good manufacturing practices (GMP).

ICH guidance, Eudralex Vol. 4. + Annexes

4 Demonstrate knowledge of the ICH Q9 and Q10 guidance documents as relating to QRM and PQMS for a licensed production facility.

Quality Risk Management process and Pharmaceutical Quality Management System.

5. Interpret and understand the relevance of auditing as a means of monitoring the production of safe and efficacious pharmaceutical and medical device products in a GMP environment.

Introduction to GMP and Auditing. (QP role, QMS and role of audits in a GMP environment).

Quality systems. Corrective and Preventive actions (Containment, correction, effectiveness checks), Change Control, Validation, Training, Calibration, Documentation, EHS, Lean Six Sigma/continuous improvement.

5 Source, interpret and apply GMP principles to different case scenarios and identify potential issues that would result in implementation of Corrective and Preventative Actions.

Audit Process- Audit types, techniques, auditor role. Auditing tools, Audit phases, Audit Agendas, Audit preparation, questionnaires and checklists.

Teaching and Learning Strategy

This module will be delivered full time. This will include lectures, and site visits augmented by independent learning and directed learning. This approach is expected to address student learning needs. Moodle will be used as a repository of educational resources and as a potential means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

This module will be assessed using a combination of end of semester final exam (60%), continuous assessment and course work (40%).

The continuous assessment and course work will involve Short Answer Questions/Multiple Choice Questions/Assignment Work where students will be required to (i) demonstrate an understanding of core module concepts, and (ii) presentations on topics which demonstrates the student's ability to critically evaluate an aspect of the subject area. there will be a number of MCQs given during the semester

Repeat Assessment Strategies

Repeat Continuous Assessment and/or Final Exam.

Additional Facilities

Laboratories, Flat classrooms, Final examination centres.

| Indicative Coursework and Continuous Assessment: | | 40 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Assignment Short Answer Questions/Multiple Choice Questions/Assignment Work | 20 % | OnGoing | 1,2,3,4 |
| Assignment | Case Study and presentations | 20 % | OnGoing | 4,5,6 |

| End of Semester / Year Formal Exam: | | 60 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| UNKNOWN | Final Exam | 60 % | End of Term | 1,2,3,4,5,6 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|----------------------|----------------|------------------|-------|-----------|
| Lecture | Lecture | Tiered Classroom | 3 | Weekly |
| Group Learning | Group Learning | Flat Classroom | 1 | Weekly |
| Independent Learning | Self Study | UNKNOWN | 4 | Weekly |

Recommended Reading Book List

Harrison, C F., (2016). *Pharmaceutical Regulatory Affairs*. Createspace Independent Publishing Platform.
ISBN 1537090747 ISBN-13 9781537090740

Healthcare, M., (2017). *Rules and Guidance for Pharmaceutical Manufacturers and Distributors (Orange Guide) 2017* .
ISBN 0857112856 ISBN-13 9780857112859

Syed, C., (2017). *Fundamentals of US Regulatory Affairs*.
ISBN 0997769777 ISBN-13 9780997769777

Literary Resources

N/A

Journal Resources

None.

Online Resources

EudraLex - Volume 4 - Good Manufacturing Practice (GMP) guidelines. Chapters 1- 9. - Self Inspection. : https://ec.europa.eu/health/documents/eudralex/vol-4_en

EudraLex - Volume 1 - Pharmaceutical legislation for medicinal products for human use. : https://ec.europa.eu/health/documents/eudralex/vol-1_en

EudraLex - Volume 2 - Pharmaceutical legislation on notice to applicants and regulatory guidelines for medicinal products for human use.:
https://ec.europa.eu/health/documents/eudralex/vol-2_en

The European Medicines Agency (EMA), marketing authorisation applications (MAA) .: <https://www.ema.europa.eu/en/human-regulatory/marketing-authorisation>.

EudraLex - Volume 4 - Good Manufacturing Practice (GMP) guidelines. Chapters 1- 9. : https://ec.europa.eu/health/documents/eudralex/vol-4_en.

ICH Quality Guidelines.: <https://www.ich.org/products/guidelines/quality/article/quality-guidelines.html>

ICH, CTD/Work Products - M4 : The Common Technical Document.: <https://www.ich.org/products/ctd.html>

<https://www.hpra.ie/>

<https://www.ema.europa.eu/en>

<https://www.fda.gov/>

Other Resources

None

Programme Membership

SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science
SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology
SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science

| | | | |
|----------------------|-------------------------|-----------------------|-----------------------|
| Full Title | Microbial Biotechnology | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Mary Heneghan | | |

Module Description

The aim of this module is to review current knowledge, underpinning principals and recurrent themes in microbial biotechnology. Microorganisms are fundamental to many industrial processes and students studying this module will gain an understanding of the use of bacteria, yeast, fungi and algae in the production of valuable commodities. The module describes the use of microorganisms in biotechnology, the application of microbial enzymes in industry, the use of recombinant DNA in the production of products, fermentation processes, and downstream processing.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Evaluate the potential for microbial cells in biotechnology.
2. Review the molecular methodologies for engineering microbes for use in the biotechnology industry.
3. Compare and contrast industrial fermentations.
4. Discuss the fundamental characteristics of various downstream processes used in the purification of biotechnological products.
5. Demonstrate proficiency in the performance of a variety of relevant laboratory techniques. Analyse, collate and report on experimental data generated in practical sessions.

Indicative Syllabus

Evaluate the potential for microbial cells in biotechnology.

- Bacteria
- Yeast
- Fungi
- Algae

Review the molecular methodologies for engineering microbes for use in the biotechnology industry.

- PCR, restriction enzymes, plasmids
- Cloning
- Transformation
- Homologous recombination
- Expression systems

Compare and contrast industrial fermentations.

- The growth cycle
- Factors effecting microbial growth
- Fermentation: modes of operation
- Fermentors/Bioreactors

Discuss the fundamental characteristics of various downstream processes used in the purification of biotechnological products.

- Development of a purification scheme
- Centrifugation
- Chromatography
- Filtration
- Chemical extractions
- Monitoring of purification

Demonstrate proficiency in the performance of a variety of relevant laboratory techniques. Analyse, collate and report on experimental data generated in practical sessions. Some of these may include (but not limited to):

- Microbial culturing
- Cloning and transformation
- PCR
- Agarose Gel Electrophoresis
- Chromatography

- Immunoblots

Teaching and Learning Strategy

This module will be delivered full-time. A combinatorial teaching and learning strategy will be employed for the delivery of microbial biotechnology. This will include lecturer – directed instruction to deliver knowledge, active learning to promote engagement of the students in their own learning and cognitive activation to motivate students and stimulate higher order skills such as critical thinking, problem solving and decision making. Visualisation techniques will be utilised where possible to bring difficult concepts to life and highlight their practical applications. Co-operative learning will be encouraged, whereby students will work together to complete revision activities (e.g. crosswords, word searches, double puzzles). These revision activities will be provided at the end of each topic. A learning platform (such as moodle) will be used as a repository of educational resources and as a means of assessment (e.g. quizzes, uploading assignments and journals).

Assessment Strategy

Assessment of the microbial biotechnology module will include both continuous assessment (50%) and a terminal exam (50%). Students are required to attend a minimum of 75% of laboratory sessions. The final exam will examine the students' knowledge of the module and assess the ability of the student to communicate that knowledge in a suitable manner. Formative assessments will be conducted at the end of each topic to evaluate student comprehension, learning needs and academic progress. These assessments will identify concepts that students are struggling to understand and skills they are having difficulty in acquiring. Continuous assessment will involve report writing (2 reports), data analysis and assessment of laboratory skills. The students must reach an assigned gate (mark) in the final exam and achieve 40% overall to pass the subject.

Repeat Assessment Strategies

If a student fails to achieve 40% in the module they will be required to re-sit the exam, resubmit or submit laboratory reports, write a theory assignment or a combination of these. Repeat assessments will be decided on a case by case basis, and will be informed by the amount and quality of continuous assessment submitted during the semester, and the performance of the student in the final exam.

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|--|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Self assessment quizzes | - % | OnGoing | 1,2,3,4 |
| UNKNOWN | Practical Evaluation Practicals /workshops | 50 % | OnGoing | 1,2,3,4,5 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|---------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final theory examination. | 50 % | End of Term | 1,2,3,4 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|-------|-----------|
| Lecture | Lecture/tutorial | Flat Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2 | Weekly |
| Independent Learning | Self study | UNKNOWN | 3 | Weekly |

Recommended Reading Book List

Walsh, G., (2013). *Biopharmaceuticals*. John Wiley & Sons.
ISBN 9781118687383 ISBN-13 1118687388

Nelson, L., (2016). *Principles of Biochemistry 7e*.
ISBN 1464126119 ISBN-13 9781464126116

Martinko, M., (2014). *Brock Biology of Microorganisms*. Pearson Higher Ed.
ISBN 9780321943743 ISBN-13 0321943740

Jacquelyn, L., (2014). *Microbiology*.
ISBN 1118934806 ISBN-13 9781118934807

El-Mansi, M., (2019). *Fermentation Microbiology and Biotechnology*. CRC Press.
ISBN 113858102X ISBN-13 9781138581029

Literary Resources

Additional reading and resources will be recommended by the lecturer.

Journal Resources

Additional reading and resources will be recommended by the lecturer.

Online Resources

Additional reading and resources will be recommended by the lecturer.

Other Resources

| |
|------|
| None |
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| Programme Membership |
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| SG_SBIOM_B07 201900 Bachelor of Science in Biomedical Science SG_SMEDI_H08 201900 Bachelor of Science (Honours) in Medical Biotechnology SG_SBIOS_H08 202300 Bachelor of Science (Honours) in Biomedical Science |
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| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | PHARMACEUTICAL ANALYSIS | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Geraldine Duignan | | |
| Co Authors | Fiona McArdle, Carmel Moran, Tom Patton | | |

Module Description

This module addresses the essential practical and theoretical aspects of pharmaceutical analysis with a particular focus on separation science. Students will engage in testing and reporting on the quality of a selection of pharmaceutical APIs and finished products using both compendial and non-compendial methods with due consideration to GMP throughout. The module also addresses the issues of quality within measurements and also addresses aspects of sample preparation and pretreatment.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Describe the purpose of the most common analytical tests carried out in the context of pharmaceutical manufacturing and quality control.
- Relate key structural and physicochemical properties of pharmaceutical compounds to their analysis: eg appropriate analytical techniques, sample preparation and analytical conditions.
- Identify suitable sample preparation techniques for a variety of pharmaceutical samples.
- Explain the chemistries of some of the phases used in instrumental chromatographic techniques.
- Explain what is meant by a valid analytical method and the steps taken to ensure validity in analysis.
- Perform qualitative and quantitative laboratory analyses on Pharmaceutical APIs and Finished Products using a selection of compendial and non-compendial methods and with due consideration of GLP/GMP
- Interpret data from qualitative and quantitative chromatographic determinations in relation to a stated test hypothesis or quality specification.

Indicative Syllabus

- Describe the purpose of the most common analytical tests carried out in the context of pharmaceutical manufacturing and quality control.
 - Role of QC in pharmaceutical manufacturing environment
 - Compendial methods: Identity, Impurities/related substances, Assay, other characteristics.
 - Relate key structural and physicochemical properties of pharmaceutical compounds to their analysis: eg appropriate analytical techniques, sample preparation and analytical conditions.
 - Intermolecular interactions, partition coefficients, ionisation pka/buffers, stereochemistry.
 - Identify suitable sample preparation techniques for a variety of pharmaceutical samples:
 - Solubility, filtration, centrifugation, solvent extraction, solid phase extraction.
 - Explain the chemistries of some of the phases used in instrumental chromatographic techniques.
 - Mobile and stationary phase chemistries: HPLC/UPLC, GC, Ion Chromatography,
 - Explain what is meant by a valid analytical method and the steps taken to ensure validity in analysis.
 - Validation requirements ICHQ2
 - System suitability requirements PhEur
 - Perform qualitative and quantitative laboratory analyses on Pharmaceutical APIs and Finished Products using a selection of compendial and non-compendial methods and with due consideration of GLP/GMP
- In relation to Assays and Related Substances reviewing use of Chemical (titration) & spectroscopic (FTIR/UV) techniques and emphasising competencies in performing chromatographic separations: HPLC (in particular), GC, Ion Chromatography.
- Identify relevant hazards and manage risks for safety.
 - source and apply compendial method or non-compendial SOP

- Prepare samples/standards and set up instrumentation
- Record all relevant data in consideration of GLP/GMP

7. Interpret data from qualitative and quantitative chromatographic determinations in relation to a stated test hypothesis or quality specification.

- Quality specifications for pharmaceutical samples.
- Recording and documenting
- Processing qualitative and quantitative analytical data
- Interpretation of chromatographic data including system suitability - in relation to quality specification.

Teaching and Learning Strategy

This module will be taught through a variety of modes including lectures, tutorials and laboratory sessions - with individual and Team Based approaches

The aim is to blend theory and practice in gradually more applied contexts, and to allow students opportunities to self assess, explore and learn from each other within the clear framework of quality analytical methods established in compendial texts for pharmaceutical analysis and regular feedback from staff.

Beginning: Week 1-4: Individual students work to establish current competency levels and identify individual learning goals. Theory revises basic functional group chemistry and physicochemical properties related to a selection of pharmaceutical compounds and laboratory activities centre around independence in basic laboratory competencies from yr 2. Students will have the opportunity to learn from each other and peer review each others work but the focus is on individual competency.

Middle: Week (5-10) Team focussed laboratory sessions tutorial workshops are used to allow student groups to plan, execute valid laboratory analyses using compendial and non-compendial methods and to report on results with due consideration of documentation requirements for GMP. Lectures are provided concurrently on important functional aspects of the techniques used. Students take individual responsibility for documentation, interpretation and reporting of results.

End: Demonstration of advanced techniques and Individual competencies are reviewed (Week 11-12)

Assessment Strategy

This module is 65% continuous assessment 50% practical and 15% continuous assessment theory and 35% final examination. The students must reach an assigned gate (30%) in the final examination and achieve 40% overall to pass the module

SUMMATIVE:

Practical skills, report writing and data evaluation will be assessed at regular intervals (2-3 weeks). (50%)

Theory Assignment: Based on Application notes (15%)

Final exam (35%)

FORMATIVE: Short questions, MCQs and simulated data for interpretation will be used formatively in workshops and on the moodle platform.

Repeat Assessment Strategies

Repeat exam if grade in final exam is <30%

Repeat attendance may be required if attendance is less than 75% in practical sessions.

Repeat CA if all other conditions have been met and student has failed to achieve passing grade.

Additional Facilities

Laboratory for sample preparation

Instrumentation Lab

A flat classroom and PC laboratory for the short tests.

An examination hall for the final examination.

| Indicative Coursework and Continuous Assessment: | | 65 % | | |
|--|---|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Short questions and practical assessments | - % | Week 2 | 1,2,3,6,7 |
| Written Report/Essay | Laboratory Reports | 40 % | OnGoing | 3,5,6,7 |
| Assignment | Assignment | 15 % | Week 6 | 2,4,7 |
| Practical Evaluation | Independently perform analysis | 10 % | Week 11 | 6,7 |

| End of Semester / Year Formal Exam: | | 35 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 35 % | End of Semester | 1,2,3,4,5,7 |

| Full Time Delivery Mode: | | | | |
|--------------------------|------------------------|-----------------------------|-------|-----------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Tiered Classroom | 2 | Weekly |
| Problem Based Learning | Problem Based Learning | Problem Based Learning Room | 1 | Weekly |
| Independent Learning | Self study | Not Specified | 8 | Weekly |

| | | | | |
|------------------------|-----------------------------------|--------------------|---|--------|
| Practical / Laboratory | Pharmaceutical Analysis Practical | Science Laboratory | 3 | Weekly |
|------------------------|-----------------------------------|--------------------|---|--------|

Required Reading Book List

Watson, G., (2016). *Pharmaceutical Analysis*. Elsevier.
ISBN 0702069892 ISBN-13 9780702069895

Elizabeth, V., (2007). *Quality Assurance in Analytical Chemistry*. Wiley-Interscience.
ISBN 047001203X ISBN-13 9780470012031

Harris, C., (2015). *Quantitative Chemical Analysis*. WH Freeman.
ISBN 131915414X ISBN-13 9781319154141

Literary Resources

The British Pharmacopoeia 2019

The European Pharmacopoeia 9th Ed.

Handbook of Pharmaceutical Analysis by HPLC, Satinder Ahuja, Michael Dong, Elsevier, 2005.

Journal Resources

Journal of Pharmaceutical and Biomedical analysis: ISSN: 0731-7085,

Online Resources

<https://www.chromacademy.com/>

<http://www.sepscience.com>

<http://www.separationsnow.com>

Programme Membership

SG_SPHAR_B07 201900 Bachelor of Science in Pharmaceutical Science with Drug Development

SG_SPHAR_H08 201900 Bachelor of Science (Honours) in Pharmaceutical Science with Drug Development

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|---|--|-----------------------|--------------------------|
| Full Title | BIOCONTAMINATION CONTROL | | |
| Status | Uploaded to Banner | Start Term | 2019 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Paul Walsh | | |
| Module Description | | | |
| This module aims to provide students with a fundamental knowledge and understanding of the general principles and methods of Biocontamination control; establishing and verifying the formal system for contamination control and associated test methods and requirements; traditional and modern methods of microbial detection; expressing, interpreting and reporting results; training and documentation requirements. | | | |
| Learning Outcomes <i>On completion of this module the learner will/should be able to:</i> | | | |
| 1. | Discuss and evaluate the most relevant biocontamination organisms for the biopharmaceutical industry and the typical sources of each. | | |
| 2. | Identify and discuss appropriate prevention techniques for each contaminant. | | |
| 3. | Establish the theory behind the biocontamination detection test methods available, including traditional and rapid identification testing. | | |
| 4. | Develop and justify an appropriate monitoring regime for a pharmaceutical/biopharmaceutical facility. | | |
| 5. | Perform some research on a relevant topic and analyse, evaluate and draw conclusions accordingly. | | |
| 6. | Communicate and explain scientific data relating to biocontamination control. | | |
| Indicative Syllabus | | | |
| General principles and methods of Biocontamination control. | | | |
| Basic microbiology and specific biocontamination organisms of relevance. | | | |
| The formal system for biocontamination control and associated test methods and requirements. | | | |
| Traditional and modern methods of microbial detection. | | | |
| Potential sources of biocontamination. | | | |
| Techniques & tools for prevention and correction/removal of biocontamination including, monitoring and detection methods. | | | |
| Teaching and Learning Strategy | | | |
| N/A | | | |
| Assessment Strategy | | | |
| Continuous Assessment of Course Work - 50% of marks. | | | |
| End of term written exam - 50% of marks. | | | |
| Repeat Assessment Strategies | | | |
| N/A | | | |
| Additional Facilities | | | |
| N/A | | | |
| Indicative Coursework and Continuous Assessment: | | 50 % | |
| Form | Title | Percent | Week (Indicative) |
| | | | Learning Outcomes |

| | | | | |
|-----------------------------------|---------------------------|------|---------|-------------|
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | Week 6 | 1,2,3,4 |
| Multiple Choice/Short Answer Test | Multiple Choice Questions | 15 % | Week 11 | 1,2,3,4,5,6 |
| Assessment | LAQ | 20 % | Week 14 | 1,2,3,4,5,6 |

| | | | | |
|--|--------------|----------------|--------------------------|--------------------------|
| End of Semester / Year Formal Exam: | | 50 % | | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | End of Term | 1,2,3,4 |

| | | | | |
|---------------------------------|--------------------------|-----------------|--------------|------------------|
| Part Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Online | Not Specified | 1 | Weekly |
| Directed Learning | Course Notes / Slides | Not Specified | 3 | Weekly |
| Independent Learning | Mini Research Assignment | UNKNOWN | 3 | Weekly |

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| Literary Resources |
| Hugo and Russell's: Pharmaceutical Microbiology (Seventh Edition) Editor(s): Stephen P Denyer, Norman A Hodges, Sean P Gorman Print ISBN: 9780632064670 Online ISBN: 9780470988329. |
| Microbial Limit and Bioburden Tests: Validation Approaches and Global Requirements, Second Edition, 2nd Edition By Lucia Clontz. ISBN: 978-1-4200534-8-7. |
| Rapid Microbiological Methods in the Pharmaceutical Industry Editors: Martin C. Easter ISBN: 978-1-57491-141-1 (hardback) 978-0-203-01087-7 (electronic). |

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|--------------------------|
| Journal Resources |
| N/A |

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|-------------------------|
| Online Resources |
| N/A |

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|------------------------|
| Other Resources |
| None |

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| Programme Membership |
| SG_SBIOP_J07 201900 Bachelor of Science in Biopharmaceutical Science (Add-on) SG_SBIOE_E07 201900 Certificate in Bioprocess Engineering |



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MCRO07005 2023 Applied Microbiology and Cleanroom Technology

Elective Delivered in Stage 3 Semester 5

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|----------------------|---|-----------------------|-----------------------|
| Full Title | Applied Microbiology and Cleanroom Technology | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will provide the learner with an overview of the various applications of microbiology with emphasis on the thematic areas of food production, environmental science and clinical microbiology. Aseptic production in the clean room will also be introduced with details on the technologies involved in creating and maintaining a cleanroom environment. The learner will be familiarised with the microbial tests that must be performed on sterile and non-sterile pharmaceutical products and medical devices to ensure their safety.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|---|
| 1. | Explain the relevance of microorganisms in the food industry |
| 2. | Critique the roles of microorganisms in both natural and engineered environments. |
| 3. | Describe the interactions of microbes and humans in disease. |
| 4. | Appraise the role and implications of biofilms in establishing microbial growth in nature, in disease states and in cleanroom environments. |
| 5. | Evaluate the design and operation of cleanrooms and describe how these environments are maintained |
| 6. | Describe the approaches used for microbiological testing of sterile and non-sterile pharmaceutical products and medical devices. |
| 7. | Demonstrate laboratory skills in manipulating samples from each module thematic area. |

Indicative Syllabus

Food Microbiology

- Factors influencing proliferation of microorganisms in food
- Controlling microbial growth in food
- Role of microorganisms in food spoilage and food illnesses

Environmental Microbiology

- Roles of microorganisms in natural environments
- Syntrophic relationships in the environment
- Microbiological testing of water

Biofilms in Nature and Disease

- The establishment of biofilms
- Communication of cells within biofilms
- Phenotypic characteristics of biofilms
- The role of biofilms in disease

Medical Microbiology and Biotechnology

- Epidemiology and host/microbe relationships
- Virulence factors
- Clinical microbiology tests

Cleanroom Technology

- The design and technology of cleanrooms
- Sampling and monitoring clean rooms for contamination
- Disinfectants and cleaning validation

Teaching and Learning Strategy

Laboratory Work, Lectures

| Assessment Strategy | | | | |
|--|-----------------------|--------------------|--------------------------|--------------------------|
| Final Examination, Essays, Laboratory work | | | | |
| Repeat Assessment Strategies | | | | |
| As per the University's policy | | | | |
| Additional Facilities | | | | |
| | | | | |
| Indicative Coursework and Continuous Assessment: | | | 50 % | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Lab Report | Laboratory Practicals | 40 % | OnGoing | 1,2,3,4,5,6,7 |
| Written Report/Essay | Essay | 10 % | Week 6 | 1,2,3,4 |
| End of Semester / Year Formal Exam: | | | 50 % | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5,6 |
| Full Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 4 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |
| Required Reading Book List | | | | |
| Gilmore, F., Denyer, P., (2023). <i>Hugo and Russell's Pharmaceutical Microbiology</i> . John Wiley & Sons. ISBN 9781119434498 ISBN-13 1119434491 | | | | |
| Madigan, T., Bender, S., Buckley, H., Sattley, W., Stahl, A., (2018). <i>Brock biology of microorganisms</i> . Pearson Higher Education. ISBN 1292235101 ISBN-13 9781292235103 | | | | |
| Literary Resources | | | | |
| | | | | |
| Journal Resources | | | | |
| | | | | |
| Online Resources | | | | |
| www.fems-microbiology.org/ http://www.sgm.ac.uk/ http://www.asm.org/ http://aem.asm.org/ http://www.fda.gov/Food/ | | | | |
| Other Resources | | | | |
| | | | | |
| Programme Membership | | | | |
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|----------------------|------------------------|-----------------------|-----------------------|
| Full Title | Mammalian Cell Culture | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

The module will provide an overview of the principles of mammalian cell culture, its use in the biopharma industry and practical skills in the culture and manipulation of mammalian cells.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Discuss the principles of mammalian cell culture.
2. Analyse the importance of aseptic procedures in the culture of mammalian cells.
3. Describe the parameters that influence cell growth and scale up of mammalian cell culture.
4. Appreciate the use of cell culture in the Biopharma industry.
5. Demonstrate proficiency in the manipulation and maintenance of mammalian cultures.

Indicative Syllabus

General principles of mammalian cell culture

- Principles of mammalian cell culture
- Aseptic technique
- Equipment requirements
- Growth media, culturing and subculturing

Applications of cell culture

- Scale up of animal cell culture
- Cell culture lines and their conditions to produce biopharma products
- Industrial applications of mammalian cell culture
- Research applications of mammalian cell culture

Teaching and Learning Strategy

Laboratory Work, Lectures, Use of Blackboard as a repository

Assessment Strategy

Laboratory work and reports, OSCE

Repeat Assessment Strategies

AS per the University's policy

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 100 % | | |
|--|------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Lab Report | Portfolio/Learning Log | 80 % | OnGoing | 1,2,3,4 |

| | | | | |
|-------------------|------|------|---------|---|
| Skills Evaluation | OSCE | 20 % | Week 12 | 5 |
|-------------------|------|------|---------|---|

| Full Time Delivery Mode: | | | | |
|---------------------------------|----------------------|--------------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lectures | Flat Classroom | 2 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |

| Required Reading Book List |
|--|
| Capes-Davis, A., Freshney, R., (2020). <i>Freshney's Culture of Animal Cells</i> . ISBN 1119513014 ISBN-13 9781119513018 |

| Recommended Reading Book List |
|---|
| , K., Aulton, E., (2021). <i>Aulton's Pharmaceuticals</i> . Elsevier. ISBN 070208154X ISBN-13 9780702081545 |
| Freshney, R., (2016). <i>Culture of Animal Cells</i> . John Wiley & Sons. ISBN 1118873653 ISBN-13 9781118873656 |

| Literary Resources |
|---------------------------|
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| Journal Resources |
|--------------------------|
| |

| Online Resources |
|-------------------------|
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| Other Resources |
|------------------------|
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| Programme Membership |
|-----------------------------|
| |

| | | | |
|----------------------|--------------------------|-----------------------|-----------------------|
| Full Title | Pharmaceutical Chemistry | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will develop the basic concepts of sample preparation and the separation of a wide variety of molecules that are important in the pharmaceutical industry. It will demonstrate the important principles of method development and the chromatographic factors that affect these separations and provide a thorough understanding of chromatographic method validation and transfer.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Determine the most suitable sample preparation technique for a wide range of pharmaceuticals.
- Compare the different chromatographic techniques and their applications in the pharmaceutical industry.
- Examine the use of volumetric analysis in the pharmaceutical industry.
- Develop an understanding of method development, validation, and transfer in industry.
- Appraise the importance of drug stability testing and methods of assessment.
- Demonstrate both theoretical and practical knowledge of laboratory techniques, synthesis, purification, and identification of organic compounds.

Indicative Syllabus

Physicochemical properties of drugs

- Ionisation and solubility characteristics of drugs
- pKa, log P and K_{sp} values of drugs
- Chirality and Stereochemistry of drugs and degradants

Sample Preparation

- Extraction methods for drug products
- Extraction methods for biological samples
- Chemical modification
- In-line and batch processes for pre-concentration

Chromatography

- Thin Layer Chromatography (TLC)
- Gas Chromatography (GC)
- High Performance Liquid Chromatography (HPLC)
- Ion Chromatography

Volumetric Analysis of Drugs

- Design of an assay
- Assay of unit dose medicines
- Redox titrations
- Limit tests
- Gravimetric Analysis
- Coulometric analysis
- Evaluation of direct and indirect methods of quantification

Method Development, Validation and Transfer

- Strategy and steps for the validation of methods
- Quality control plan and implementation for routine analysis
- Parameters for method validation
- Transferring validated routine methods

Stability of Drugs

- Origins of Impurities and Residual Solvents
- Effects of storage conditions
- Degradation Experiments and Studies
- Data evaluation

Teaching and Learning Strategy

Laboratory Work, Lectures, Use of Blackboard as a repository

Assessment Strategy

Examination, Laboratory work, Laboratory Exam, Presentation

Repeat Assessment Strategies

As per the University's policy

Additional Facilities

Indicative Coursework and Continuous Assessment:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|--------------------|-------------------|----------------|--------------------------|--------------------------|
| Lab Report | Practical Reports | 40 % | OnGoing | 1,2,3,4,5,6 |
| Individual Project | Presentation | 10 % | Week 6 | 1,2,3,4,5 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|-----------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 4 | Weekly |

Recommended Reading Book List

Watson, G., (2020). *Pharmaceutical Analysis*. Elsevier.
ISBN 0702078077 ISBN-13 9780702078071

Literary Resources

Journal Resources

Online Resources

Other Resources

Programme Membership

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Pharmaceutical Processes and Medical Devices | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will introduce the learner to the basic principles and unit operations involved in pharmaceutical processing. It will also equip the student with knowledge of process diagrams and designs along with some information on waste management. It will also provide the student with information on medical device manufacturing and associated processes.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Appraise the basic principles associated with pharmaceutical processing
2. Examine the fundamental transport operations involved in pharmaceutical processes.
3. Assess strategies for waste management in the pharmaceutical industry.
4. Examine the processes involved in the development and manufacture of medical devices and explain the packaging and sterilisation processes required for medical devices.
5. Assess the requirements for steam and WFI in pharmaceutical processing.

Indicative Syllabus

Introduction to Pharmaceutical Processes

- Mass transfer, heat transfer and momentum transfer
- Process control (lean and six sigma)
- Fluid moving devices, piping and heat exchangers

Process Engineering and Unit Operations

- Batch vs continuous operations
- Performance test runs and troubleshooting
- Cost cutting measures
- Process intensification

Waste Management

- Waste minimisation and waste disposal
- Waste treatment processes
- Hazardous waste

Medical Device Manufacturing Processes

- Injection moulding
- Extrusion and thermoforming processes
- Typical medical devices
- R+D and their manufacturing steps
- Packaging
- Sterilisation processes
- **Steam & WFI**
 - Steam as a heating mechanism
 - Water preparation and storage
 - Water purity

Teaching and Learning Strategy

Field Trips, Lectures, Use of Blackboard as a repository

| Assessment Strategy | | | | |
|--|--------------------|------------------|--------------------------|--------------------------|
| Class Tests, Site Visit Reports | | | | |
| Repeat Assessment Strategies | | | | |
| As per the University's policy | | | | |
| Additional Facilities | | | | |
| | | | | |
| Indicative Coursework and Continuous Assessment: | | | 100 % | |
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Class Test | 10 % | Week 6 | 1,2,3,4,5 |
| Closed Book Exam | Class Test | 10 % | Week 12 | 1,2,3,4,5 |
| Written Report/Essay | Site Visit Reports | 80 % | OnGoing | 1,2,3,4,5 |
| Full Time Delivery Mode: | | | | |
| Type | Description | Location | Hours | Frequency |
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Off-Site Activity | Site Visits | Offsite Facility | 2 | Weekly |
| Required Reading Book List | | | | |
| Kucklick, R., (2012). <i>The Medical Device R&D Handbook, Second Edition</i> . CRC Press. ISBN 9781439811894 ISBN-13 143981189X | | | | |
| Erwin, D., (2014). <i>Industrial Chemical Process Design, 2nd Edition</i> . McGraw Hill Professional. ISBN 9780071819800 ISBN-13 0071819800 | | | | |
| Literary Resources | | | | |
| | | | | |
| Journal Resources | | | | |
| | | | | |
| Online Resources | | | | |
| | | | | |
| Other Resources | | | | |
| | | | | |
| Programme Membership | | | | |
| | | | | |

| | | | |
|----------------------|-------------------------|-----------------------|-----------------------|
| Full Title | Quality and Regulations | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

The module will deliver an overview of the role of quality in the management of the pharmaceutical, biopharmaceutical and medical device industries. The module will provide an introduction to the legislation governing the authorisation of medicinal products and devices in Ireland and in Europe. The roles and responsibilities of the MA holder, the QP and the competent authorities will also be explored.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Analyse the role quality has in the pharmaceutical, biopharmaceutical and medical device industries.
2. Discriminate between the principles of QA, QC, GLP, GCP, cGMP and demonstrate the benefits of their implementation.
3. Discuss how medicinal products are authorised in Ireland and Europe.
4. Describe the role of competent authorities in the regulation of medicinal products and devices.

Indicative Syllabus

Quality

- The role of quality in the of the pharmaceutical, biopharmaceutical and medical device industries
- QA, QC, GLP, TQM
- QMS, Business excellence
- Health and safety management systems

cGMP

- Personnel, Premises and equipment
- Documentation
- Contract Manufacture & Analysis
- Complaints and product recalls, Traceability
- Self-Inspection
- Validation
- CAPA

Regulation of The Pharmaceutical, Biopharmaceutical and Medical Device Industries

- History of the regulation of the industry
- Authorization of medicinal products and devices
- Role of regulatory authorities
- EDQM
- Clinical Trials
- Counterfeit Medicines

Teaching and Learning Strategy

Case studies, Lectures, Use of Blackboard as a repository

Assessment Strategy

Final Examination, Multi-Choice Questions, Presentation

Repeat Assessment Strategies

As per the University's policy

Additional Facilities

Indicative Coursework and Continuous Assessment:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|---------------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | MCQ | 10 % | Week 6 | 1,2,3,4 |
| Closed Book Exam | MCQ | 10 % | Week 12 | 1,2,3,4 |
| Group Project | Groups Presentation | 30 % | Week 11 | 1,2,3,4 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|-------------|--------------------|-----------------|--------------|------------------|
| Lecture | Lectures | Flat Classroom | 3 | Weekly |

Recommended Reading Book List

Medicines, G., Healthcare, M., (2017). *Rules and Guidance for Pharmaceutical Manufacturers and Distributors (Orange Guide) 2017*.
ISBN 0857112856 ISBN-13 9780857112859

Literary Resources

Journal Resources

Online Resources

<http://www.hpra.ie/> (Health Products Regulator Authority)
<http://www.fda.gov> (FDA)
<http://www.inab.ie/> (The Irish National Accreditation Board (INAB))
<http://www.ema.europa.eu/> (The European Medicines Agency)
<http://www.iso.org/iso/home.html> (ISO - International Organization for Standardization)
http://http://ec.europa.eu/index_en.htm

Other Resources

Programme Membership

| | | | |
|----------------------|-------------------------|-----------------------|-----------------------|
| Full Title | Medicinal Drug Analysis | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module will provide learners with an understanding of spectral analysis of organic compounds and develop techniques & procedures important for structural elucidation.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Examine the principles, instrumentation, and applications of UV/visible, IR, and mass spectroscopy.
2. Apply the principles for the interpretation of spectral data.
3. Perform calculations to obtain information from spectroscopic data.
4. Demonstrate knowledge and understanding by solving various spectroscopic problems.
5. Predict spectroscopic behaviour from molecular structure and formula.
6. Integrate the basic theoretical concepts with the practical aspect of the module.

Indicative Syllabus

Electronic and Vibrational Spectroscopy

- Relationship of electronic transitions to molecular structure
- Qualitative analysis of drug molecules from UV/Visible spectra
- Interpretation of IR spectra

Mass Spectrometry

- Ion analysis and fragmentation patterns
- Mass spectral data interpretation
- Pharmaceutical and biological applications

N.M.R. Spectroscopy

- Fundamental principles of NMR
- Chemical shifts for NMR spectroscopy
- Spin-spin coupling in ^1H and ^{13}C NMR spectroscopy
-

Combined Methods

- Approximately 50% of the time for the theory course will be dedicated to "workshops" on structural elucidation of organic molecules from their (UV, IR, MS, and NMR) spectral data

Teaching and Learning Strategy

Laboratory Work, Lectures, Use of Blackboard as a repository

Assessment Strategy

Final Examination, Laboratory work, Laboratory Exam, Presentation

Repeat Assessment Strategies

As per University's policy

Additional Facilities

Indicative Coursework and Continuous Assessment:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------------|-----------------------|----------------|--------------------------|--------------------------|
| Lab Report | Laboratory Practicals | 35 % | OnGoing | 1,2,3,4,5 |
| Skills Evaluation | Practical Exam | 10 % | Week 12 | 6 |
| Oral Exam/Presentation | Presentation | 5 % | Week 11 | 1,2,3,4,5 |

End of Semester / Year Formal Exam:

50 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--------------|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,4,5 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|-----------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Flat Classroom | 3 | Weekly |
| Practical / Laboratory | Laboratory Practicals | Science Laboratory | 4 | Weekly |

Required Reading Book List

Field, L D., Li, H L., Magill, A M., (2020). *Organic Structures from Spectra*. John Wiley & Sons.
ISBN 9781119524809 ISBN-13 1119524806

Recommended Reading Book List

Silverstein, M., Webster, X., Kiemle, J., Bryce, L., (2014). *Spectrometric Identification of Organic Compounds*. John Wiley & Sons.
ISBN 9780470616376 ISBN-13 0470616377

Fleming, I., Williams, D., (2020). *Spectroscopic Methods in Organic Chemistry*. Springer.
ISBN 3030182517 ISBN-13 9783030182519

Programme Membership

| | | | |
|----------------------|------------------------|-----------------------|-----------------------|
| Full Title | Environmental Analysis | | |
| Status | Draft | Start Term | 2023 |
| NFQ Level | 07 | ECTS Credits | 10 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | UNKNOWN | | |
| Module Author | Kim McFadden | | |

Module Description

This module provides the student with an understanding of techniques used in environmental sampling, sample collection, sample pre-treatments prior to analysis and chemical analysis with a focus on water pollution.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Design and implement a water-sampling programme.
2. Practise sample collection and undertake sample pre-treatment for laboratory analysis.
3. Describe and explain the chemistry of natural waters.
4. Use wet chemistry and advanced instrumental techniques for the analysis of water, sediment, plant and animal tissue.
5. Demonstrate quality control and quality assurance in practical work.

Indicative Syllabus

The design and implementation of a water sampling programme

- Selection of parameters, analytical methods
- Sampling frequency, sample number, sample site selection

Sample collection and sample pre-treatment

- Techniques for sample collection
- Sample pre-treatment

Chemistry of natural waters

- Physical parameters e.g. residues, colour, turbidity, temperature, pH
- Chemical Parameters e.g. alkalinity, dissolved oxygen, BOD, COD, nitrates, phosphates
- **Environmental analysis**
- Metal pollutants e.g. mercury, cadmium, lead, arsenic, chromium, copper, tin
- Organic pollutants e.g. pesticides, polycyclic aromatic hydrocarbons, acrylamide
-

Teaching and Learning Strategy

Field trips, Laboratory practicals, Lectures, Use of Blackboard as a repository

Assessment Strategy

Examination, Laboratory work, Presentation, Class Test

Repeat Assessment Strategies

As per the University's policy

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|---|--|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Lab Report | Laboratory Practicals | 35 % | OnGoing | 1,2,3,4,5 |
| Assignment | Field work, practical and presentation | 5 % | Week 12 | 1,2,3,4,5 |
| Closed Book Exam | Class Test | 10 % | Week 6 | 1,3,5 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|--|--------------|----------------|--------------------------|--------------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | Week 15 | 1,2,3,5 |

| Full Time Delivery Mode: | | | | |
|---------------------------------|----------------------|--------------------|--------------|------------------|
| Type | Description | Location | Hours | Frequency |
| Lecture | Lectures | Flat Classroom | 4 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 3 | Weekly |

| Required Reading Book List | | | | |
|--|--|--|--|--|
| Vladimir, M., (2015). <i>Practical Environmental Analysis</i> . 2 nd Edition. Royal Society of Chemistry. ISBN 9780854046799 ISBN-13 0854046798 | | | | |
| Patnaik, P., (2017). <i>Handbook of Environmental Analysis</i> . CRC Press. ISBN 149874561X ISBN-13 9781498745611 | | | | |

| Recommended Reading Book List | | | | |
|---|--|--|--|--|
| Rice, W., Bridgewater, L., , , , , Federation, W., (2012). <i>Standard Methods for the Examination of Water and Wastewater</i> . Amer Public Health Assn. ISBN 0875530133 ISBN-13 9780875530130 | | | | |

| Literary Resources | | | | |
|---------------------------|--|--|--|--|
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| Journal Resources | | | | |
|--------------------------|--|--|--|--|
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| Online Resources | | | | |
|---|--|--|--|--|
| https://www.gsi.ie/en-ie/programmes-and-projects/tellus/Pages/default.aspx | | | | |
| https://www.sciencedirect.com/science/article/pii/B9780123744739006676 | | | | |
| https://www.cambridge.org/core/journals/journal-of-the-marine-biological-association-of-the-united-kingdom/article/abs/springloaded-bottomsampler/8BFC2FDB70F401430F4D607CDDA2AAEF | | | | |
| https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/marketing/global/documents/572/614/4538.pdf | | | | |
| https://www.mt.com/de/en/home/library/guides/lab-analytical-instruments/pH-Theory-Guide.html | | | | |
| https://imall.vn/wp-content/uploads/2021/07/Catalogue-Hach-HRI3P.pdf | | | | |
| https://caslab.com/EPA-Methods/PDF/EPA-Method-1302.pdf | | | | |
| https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/Water_Quality_2019.pdf | | | | |
| https://arrow.tudublin.ie/cgi/viewcontent.cgi?article=1019&context=scienmas | | | | |

| Other Resources | | | | |
|------------------------|--|--|--|--|
| | | | | |

| Programme Membership | | | | |
|-----------------------------|--|--|--|--|
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| | | | |
|----------------------|---------------------------------|-----------------------|-----------------------|
| Full Title | Applied Enzymology & Immunology | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module will provide learners with a knowledge of the applied aspects of enzymology and immunology. Applied Enzymology builds upon the principles of enzyme catalysis, enzyme inhibition, sources of enzymes and their purification. It also describes the industrial and clinical applications of enzymes and the principles of enzyme technologies. The learner will gain practical experience in the extraction of enzymes and their purification and quantification using enzyme assays. Applied Immunology will focus on antibodies and their development plus their applications in Immunoassays (IAs). The learner will gain practical experience in performing immunoassays which plays a prominent role in healthcare and industrial settings as these assays can provide an early and precise detection of analytes/biomarker in clinical samples.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|---|
| 1. | Classify enzymes, identify the factors that influence the rate of catalysis, explain and perform a number of enzyme-based assays. |
| 2. | Describe how the Michaelis- Menten kinetic constants are derived and calculated, mechanisms of enzyme catalysis and enzyme inhibition. |
| 3. | Extract an enzyme from a biological source, purify using low level purification techniques and calculate purification parameters such as % recovery, specific activity and purification factor. |
| 4. | Describe the major applications of enzymes in analytical, clinical, industrial environments and identify the technology and future prospectives and trends in regard to enzymology. |
| 5. | Explain and outline the main principles of immunochemistry such as the nature and interactions of antigen/antibody . |
| 6. | Identify the factors involved in antibody development and their potential applications in immunoassays. |
| 7. | Classify immunoassays, show knowledge with regard to labels, detection systems, platforms and perform a number of immunoassays. |
| 8. | Write scientific reports and interpret analytical data from enzyme assays and immunoassays. |

Indicative Syllabus

Applied Enzymology

- 1. Review of Protein Structure** - Amino acids, protein organisational levels (primary, secondary and tertiary and quaternary structure) and chemical bonding in proteins.
- 2. Introduction to Enzymes** - Classification, cofactors, factors affecting enzyme activity, Micahelis-Menten kinetics, kinetic constants (Km, Vmax, Ki) and enzyme inhibitors.
- 3. Enzymatic Analysis** - Enzyme design, types of assays, practical considerations and monitoring methods.
- 4. Extraction and Purification of Enzymes** - Enzyme extraction and purification procedures, determination of specific activity, purification factor and % yield as assessment criteria for a purification protocol.
- 5. Enzyme Applications, technology and future prospectives and trends** - Evaluate the applications of enzymes in industrial, analytical, pharmaceutical and clinical environments. Immobilised enzymes (adsorption, covalent coupling, entrapment, choice of matrix), biosensors, reporter enzymes and disease specific therapies (enzyme replacement and substrate reduction).

Applied Immunology

- 6. Immunoglobulins** - structure and classification.

7. Antibody development - monoclonal and polyclonal antibodies, animals and cell lines, immunisation, hybridoma production, phage display and antibody purification.

8. Classification of immunoassays - Immunoassays (no labels) - immunodiffusion and nephelometry. Immunoassays (labels) - radioisotopes, enzymes, luminescent. Homogeneous and heterogeneous immunoassays. Competitive and noncompetitive immunoassays.

9. Antibody labels, detection systems and immunoassay platforms - radioisotopes, enzymes, and fluorescence, microtiter plates, tubes, lateral flow, and microspheres.

10. Future prospectives and trends in immunoassays - formats, bioanalytical platforms, biosensing concepts and detection devices.

Teaching and Learning Strategy

This module will be delivered full time and the delivery of subject material to the student will be a combination of active learning and traditional lectures. A learning platform (such as moodle) will be used as a repository of educational resources (e.g. journals, online resource information) and also as a means of assessment (e.g. quizzes, uploading of assignments etc.). The teaching, learning and assessment strategy for this module will be based on lectures, scientific journals/publications/guidance documents, thus contributing significantly to the learning outcomes of the programme.

Assessment Strategy

All assessments are formative and summative employing the use of a final written examination (2 hrs), continuous assessments comprising of practicals plus practicals reports and MCQ assessments.

The assessment breakdown of the module is Practical and CA (50%) and Final Exam (50%)

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat final written examinations (2hrs) will be offered in the Autumn.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|--|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Multiple Choice/Short Answer Test | Class Assessment Continuous Assessment | 10 % | OnGoing | 1,2,3,4,5,6,7 |
| Lab Report | Practical Reports | 40 % | OnGoing | 8 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | End of Semester | 1,2,3,4,5,6,7 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|-------------|--------------------|-------|-----------|
| Lecture | Lecture | Not Specified | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Moorthy, K., (2008). *Fundamentals of Biochemical Calculations, Second Edition*. CRC Press.
ISBN UOM:39015073909866

Wild, D., (2013). *The Immunoassay Handbook*. Elsevier Science.
ISBN 0080970370 ISBN-13 9780080970370

Bisswanger, H., (2011). *Practical Enzymology*. Wiley-Blackwell.
ISBN 3527320768 ISBN-13 9783527320769

Okotore, O., (2015). *Essentials of Enzymology*.
ISBN 1503527239 ISBN-13 9781503527232

Vashist, K., Ht, J., (2018). *Handbook of Immunoassay Technologies*. Academic Press.
ISBN 0128117621 ISBN-13 9780128117620

Recommended Reading Book List

Belorkar, S., Jogaiah, S., (2021). *Protocols and Applications in Enzymology*. Elsevier.
ISBN 9780323912686 ISBN-13 0323912680

Yon-Kahn, J., Herv, G., (2010). *Molecular and Cellular Enzymology*. Springer.
ISBN 3642012272 ISBN-13 9783642012273

Cornish-Bowden, A., (2014). *Fundamentals of Enzyme Kinetics*. Elsevier.
ISBN 9781483161198 ISBN-13 1483161196

Literary Resources

Berg, J.M., Tymoczko, J.L. & Stryer, L. (2002) *Biochemistry*, 5th Ed. Freeman & Co., New York.

Hames, B.D. & Rickwood, D. (1991) *Gel electrophoresis of proteins: A Practical Approach*, IRL-London.

Eisenthal, R. & Danson, M. J. (1993) *Enzyme assays: A Practical Approach*, Oxford University Press.

Cochet, O., Teillaud, J. & Sautés, C. (1998) *Immunological Techniques Made Easy*, J. Wiley & Sons, New York

Deutscher, M. P. (1990) *Guide to Protein Purification (Methods in Enzymology, Vol 182)* Academic Press.

Caponi, L. & Migliorini, P. (1999) *Antibody Usage in the Lab*. Springer-Verlag Berlin/Heidelberg, New York.

Tijssen, P. (1985) *Practice and theory of enzyme immunoassays*, Elsevier, Oxford.

Gosling, J. (2000) *Immunoassays: A Practical Approach*, Oxford University Press.

Goldsby, R.A., Kindt, T.J. & Osbourne, B.A. (2000) *Kuby Immunology*. W.H. Freeman & Company.

Journal Resources

Online Resources

Other Resources

Practical Laboratory Manuals

Programme Membership

| | | | |
|----------------------|--|-----------------------|-----------------------|
| Full Title | Spectrophotometric Methods of Analysis 3.1 | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module focuses on the application of spectrophotometric methods to the identification and quantification of pharmaceutical substances. Atomic absorption and emission techniques as well as molecular absorption and emission techniques are studied in the context of providing quality control methods for drug substances and drug products. Structural techniques such as IR and NMR are also examined as tools to aid in identification of active ingredients as well as impurities or degradants. The analysis of various pharmaceuticals is carried out in the laboratory to practically illustrate the theory and enable the student to develop their analytical laboratory skills.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe and explain the operation of flame and graphite furnace atomic absorption as well as associated methods such as the hydride or cold vapour method.
2. Discuss emission methods such as ICP, and outline sample preparation methods for either absorption or emission analysis.
3. Identify common chromophores in pharmaceutical substances and discuss the use of UV/VIS spectrophotometry for calculation of drug concentrations, drug release, drug solubility etc. in either single or multicomponent formulations.
4. Explain the relationship between molecular structure and fluorescence and use data from fluorimetric measurements for quantitative pharmaceutical analysis.
5. Discuss the role of both mid IR and NIR in quality control of pharmaceutical substances.
6. Discuss the use of NMR and MS in the characterisation of structures of pharmaceutical substances.
7. Set up and use spectrophotometric instruments to examine a variety of pharmaceutical substances and use data obtained for either qualitative or quantitative analysis of such substances.

Indicative Syllabus

Theory content:

Atomic absorption - atomisation using flame and furnace techniques. Interferences. Enrichment, separation and extraction techniques. Hydride and cold vapour techniques. Background correction. Atomic emission - flame and ICP methods. Applications of both absorption and emission in pharmaceutical analysis.

Ultraviolet and Visible spectroscopy: Common chromophores in pharmaceutical substances. Calculation of drug solubility, drug release, pKa values etc. Use of standard absorptivity values. Multicomponent analysis. Chemical derivatisation and derivative spectrometry.

Molecular emission spectrometry: Molecular structure and fluorescence. Applications of fluorescence spectrophotometry in pharmaceutical analysis.

Infrared spectrophotometry: Mid-infrared in structure elucidation and as an identification technique. Applications of near-infrared in pharmaceutical analysis.

NMR and mass spectrometry for characterisation of pharmaceutical substances and for impurity profiling.

Practical programme:

Ten laboratory sessions will be conducted involving examination of pharmaceutical substances using atomic absorption, zero order and first and second derivative UV/VIS, fluorimetry, infrared and NMR spectrometry. Sample preparation and calculations for quantitative analysis of various sample components will be an integral part of the practical programme.

Teaching and Learning Strategy

2 1hr lectures per week

10 2.5hr Laboratory experiments

Video of Laboratory experiments on moodle - activity to be completed pre lab

Assessment Strategy

10 laboratory experiments - with lab reports submitted online weekly - 35% required to compile to pass

CA - 10% - various weekly online assessments

2hr final exam - closed book - on computer - 35% required to compile to pass

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module. To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat Final Exam

Additional Facilities**Indicative Coursework and Continuous Assessment:**

60 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|----------------|--|----------------|--------------------------|--------------------------|
| Open Book Exam | Assessment - various online assessments | 10 % | OnGoing | 1,2,3,4,5,6 |
| Lab Report | Practical Evaluation Laboratory work and laboratory reports submitted weekly | 50 % | End of Semester | 1,2,3,4,5,6,7 |

End of Semester / Year Formal Exam:

40 %

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|------------------|--|----------------|--------------------------|--------------------------|
| Closed Book Exam | Final Exam 2-hour - written exam on computer | 40 % | End of Semester | 1,2,3,4,5,6,7 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|------------------------|--------------------|--------------------|--------------|------------------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2.5 | Weekly |

Required Reading Book List

Watson, G., (2005). *Pharmaceutical Analysis*. Churchill Livingstone.
ISBN UOM:39015060575084

Hansen, S., Pedersen-Bjergaard, S., Rasmussen, K., (2011). *Introduction to Pharmaceutical Chemical Analysis*. John Wiley & Sons.
ISBN 9781119954330 ISBN-13 1119954339

Hamid, M., Rehman, K., (2019). *Essentials of Pharmaceutical Analysis*. Springer Nature.
ISBN 9789811515477 ISBN-13 9811515476

Literary Resources

Watson, D. G., (2005) *Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists 2nd Ed.*, Elsevier/Churchill Livingstone

Journal Resources**Online Resources**

Other Resources

Lecture notes moodle, Laboratory Manual supplied, Videos - Laboratory Experiments - available as pre Lab activity

Programme Membership

| | | | |
|----------------------|---|-----------------------|-----------------------|
| Full Title | Advanced Molecular and Biochemical Techniques | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

The main purpose of this module is to introduce the learner to theoretical and practical aspects of recombinant protein production and how this relates to upstream processing in the production of biopharmaceuticals. The module builds on molecular, microbiology and biochemistry modules in year 2 and prepares learners for more advanced studies in biopharmaceutical technology and molecular biology in year 4.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Discuss homologous and heterologous recombinant protein expression with a focus on (but not limited to) protein expression in E. coli. Distinguish between other expression hosts including yeasts, mammalian cell lines, insect cell lines, transgenic plants and animals.
2. Evaluate and carry out a variety of protein quantification methods and protein analysis techniques such as SDS-PAGE and Western Blotting and bioinformatic analysis
3. Describe protein modification methods at both the DNA codon and amino acid levels.
4. Produce and analyse a recombinant protein.
5. Recognise how the production of a protein in a recombinant cell line relates to upstream processing in biopharmaceutical production.

Indicative Syllabus

Review of proteins: structure and function. Native versus recombinant proteins

Protein production and purification schemes (introduction to upstream and downstream processing)

Cloning and protein engineering

Recombinant protein expression (homologous and heterologous)

Protein expression hosts - E. coli, yeast, mammalian cells, insect cells, plant cells

Protein expression in E. coli

Cloning and expression strains of E. coli

- E. coli promoters and induction of expression
- Protein tags and cleavage sites
- Advantages and disadvantages of E. coli as an expression host

Post-translational modifications

Protein analysis techniques:

- Protein quantification
- SDS-PAGE and Western Blotting
- Bioinformatics

Teaching and Learning Strategy

Lectures, videos highlighting key concepts, practical course, quizzes to re-enforce current learning outcomes

Assessment Strategy

This module will be assessed as follows:

- Continuous assessment 60% of final grade (**must pass**) divided into:

- Laboratory practical evaluation - 50%
- Theory CA - 10%
- Terminal examination - 40% of final grade (**must pass**)

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat formal end of year examinations are set for repeat students. Repeat CA may be offered depending on the circumstances pertaining to the repeat.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 60 % | | |
|--|--|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Course work - practical assessment and theory CA | 60 % | OnGoing | 1,2,4 |

| End of Semester / Year Formal Exam: | | 40 % | | |
|-------------------------------------|--------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Written Exam | 40 % | End of Semester | 1,2,3,5 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |
| Practical / Laboratory | Practical | Science Laboratory | 2 | Weekly |
| Independent Learning | Independent Learning | Not Specified | 3 | Weekly |

Required Reading Book List

Walsh, G., (2014). *Proteins*. John Wiley & Sons.
ISBN 9780470669853 ISBN-13 0470669853

Walsh, G., (2003). *Biopharmaceuticals*. Wiley-Blackwell.
ISBN UOM:39015056841367

Berg, M., Tymoczko, L., Stryer, L., (2002). *Biochemistry, Fifth Edition*.
ISBN UOM:39015049502183

Nelson, L., Cox, M., (2012). *Lehninger Principles of Biochemistry*. W. H. Freeman.
ISBN 1429234148 ISBN-13 9781429234146

(2016). *Intermediate Filament Associated Proteins*. Academic Press.
ISBN 0128034696 ISBN-13 9780128034699

Recommended Reading Book List

Sheehan, D., (2009). *Physical Biochemistry*. Wiley.
ISBN 0470856033 ISBN-13 9780470856031

Gault, A., McClenaghan, H., (2009). *Understanding Bioanalytical Chemistry*. Wiley.
ISBN 0470029072 ISBN-13 9780470029077

Literary Resources

Journal Resources

Protein Expression and Purification
Journal of Biotechnology

Online Resources

<https://info.addgene.org/plasmids-101-topic-page>
<https://web.expasy.org/protparam/>
<https://www.ebi.ac.uk/Tools/msa/clustalo/>
<https://web.expasy.org/translate/>

<https://pdb101.rcsb.org/>

Other Resources

Programme Membership

| | | | |
|----------------------|---------------------------------|-----------------------|-----------------------|
| Full Title | Microbiological Quality Control | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module is designed to give learners a clear understanding of the role of microbiological quality assurance and quality control, particularly as applied to the (bio)pharmaceutical and medical device sectors.

It will provide learners with the information and laboratory skills to enable them to recognise the role of the microbiologist in the production of safe and wholesome products and to participate effectively in Quality Assurance teams in industry.

It will equip learners with the skills necessary to design appropriate QC testing protocols for raw materials, waters, in-process and finished products. Learners should be able to adopt an advisory role in situations relating to Microbiological Quality Control by recommending suitable materials, equipment and procedures. 'Laboratory practical's will be delivered/rolled out to students with a lecturer led emphasis on sustainability. Students will be asked to reflect on how they may incorporate sustainability into their practical work when preparing their laboratory reports'.

Learners will have gained sufficient knowledge of the microbiology of pharmaceutical and healthcare products to enable them to take up responsible positions in QA and QC in Industry.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Describe potential microbial contamination problems which would compromise the wholesomeness and safety of Pharmaceutical and Healthcare products.
2. Define the role of the microbiologist in the implementation of appropriate Quality Assurance (QA) and Quality Control (QC) programmes.
3. Identify potential sources of microbial contamination in industry.
4. Assess specific microbiological problems associated with 'water for pharmaceutical purposes' and monitor such water.
5. Construct appropriate microbiological QC testing protocols for raw materials, waters, in-process and finished products.
6. Plan and undertake pharmacopoeial 'microbial limits tests'.
7. Perform total cell counts and viable counts, using a broad range of analytical techniques.

Indicative Syllabus

General Introduction to Pharmaceutical Microbiological Quality Assurance and Quality Control.

Microbial risks associated with pharmaceutical and healthcare products:

- Review of incidents of microbial contamination in such products
- Safety aspects. Opportunistic pathogens with particular emphasis on pharmacopoeia specified microorganisms e.g. *E. coli*, *Pseudomonas aeruginosa*, *Candida albicans*, *Serratia marcescens*, *Staphylococcus aureus*.
- Degradative spoilage effects of microbes on pharmaceutical products.

Microbiological Standards, Guidelines and Specifications for pharmaceutical and healthcare products.

Terminal sterilization. Aseptic processing.

Sources of microbial contamination in the pharmaceutical/healthcare industry: raw materials, water, personnel, air, equipment, packaging and in-use contamination.

The microbiology of 'water for pharmaceutical purposes'. Purified water. Water-for-Injection (W.F.I). Sterile Water-for-Injection (S.W.F.I). Microbiological quality of water purification systems and water distribution systems. Water sanitization methods.

The phenomenon of stressed/injured cells and their significance in microbiological analysis.

Microbial Limits Tests (MLT's): Pre-treatment of samples for microbiological analysis. Pharmacopoeia methods for qualitative and quantitative analyses.

Direct Microscopic Counts: Haemocytometer Slide.

Viable cell counting procedures: Standard Plate Counts; Membrane Filtration Technique; Most Probable Number (M.P.N) Method; S.I.M Plates; Dip Slides; Millipore

Samplers. Application of the techniques to testing for aerobes, anaerobes, yeasts and moulds, *Pseudomonas species* and indicator organisms.

Indicator Organisms: Rationale for their use. Analytical procedures for detection and enumeration of coliforms, *E. coli*, *Enterococci* and *Enterobacteriaceae*.

Teaching and Learning Strategy

Lectures, Practical Laboratory sessions, Quizzes

Assessment Strategy

The module will be assessed as follows;

- Continuous assessment 40% of final grade (**must pass**) divided into:
 - Laboratory Practical evaluation. 30%
 - Theory CA 10%
- Final written examination (2 hrs.);60% of final grade(**must pass**)

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed. As a consequence, the result for the module will be entered as a failed element (FE). To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn. In instances where the failed element (FE) relates to practical work, candidates will be required to repeat attend the practical element of the module.

Repeat Assessment Strategies

Repeat formal end of year examinations are set for repeat students. Repeat CA may be offered depending on the circumstances pertaining to the repeat.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 40 % | | |
|--|--|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Coursework- Practical assessment and theory CA | 40 % | OnGoing | 3,4,5,6,7 |

| End of Semester / Year Formal Exam: | | 60 % | | |
|-------------------------------------|----------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | End of Term Exam (2 hours) | 60 % | End of Semester | 1,2,3,4,5,6,7 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|------------------------|----------------------|--------------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2.5 | Weekly |
| Practical / Laboratory | Laboratory Practical | Science Laboratory | 2 | Weekly |

Required Reading Book List

Cappuccino, G., Welsh, T., (2017). *Microbiology: A Laboratory Manual, Global Edition*. Pearson Higher Ed.
ISBN 9781292175799 ISBN-13 1292175796

Sandle, T., (2015). *Pharmaceutical Microbiology*. Woodhead Publishing.
ISBN 9780081000441 ISBN-13 0081000448

Collentro, V., (2010). *Pharmaceutical Water*. CRC Press.
ISBN 1420077821 ISBN-13 9781420077827

Denyer, P., Hodges, N., Gorman, P., (2004). *Hugo and Russell's Pharmaceutical Microbiology*. Wiley-Blackwell.
ISBN 0632064676 ISBN-13 9780632064670

Denyer, P., Hodges, A., Gorman, P., Gilmore, F., (2011). *Hugo and Russell's Pharmaceutical Microbiology*. Wiley-Blackwell.
ISBN 1444330632 ISBN-13 9781444330632

Recommended Reading Book List

Sandle, T., (2013). *Sterility, Sterilisation and Sterility Assurance for Pharmaceuticals*. Elsevier.
ISBN 9781908818638 ISBN-13 1908818638

Sandle, T., (2012). *The CDC Handbook - A Guide to Cleaning and Disinfecting Clean Rooms*. Grosvenor House Publishing.
ISBN 9781781480809 ISBN-13 178148080X

Percival, L., Yates, V., Chalmers, R., Gray, F., (2013). *Microbiology of Waterborne Diseases*. Academic Press.
ISBN 0124158463 ISBN-13 9780124158467

Literary Resources

20/11/2021 *Pharmaceutical Microbiology* John Wiley & Sons

Journal Resources

As Per Moodle
EU.Eudralex Good Manufacturing Practice Guidelines Volume 4
European Journal of Parenteral & Pharmaceutical Sciences
Federation of European Microbiological Societies / Microbiology Reviews
Pharmaceutical Technology Europe
International Journal of Pharmaceutical Research
European Pharmaceutical Review
European Journal of Pharmaceutics and Biopharmaceutics

Online Resources

As per Moodle.
Access to the European Pharmacopoeia available online in library at <https://pheur.edqm.eu/>
Bacteriological Analytical Manual (BAM)
<https://www.fda.gov/food/laboratory-methods-food/bacteriological-analytical-manual-bam>

Other Resources

As per Moodle.
Practical Laboratory Manual.

Programme Membership

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Validation | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | Yes |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

This module covers the science and practice of validation, as it applies within the pharmaceutical and medical device sectors, with particular focus on computerised/automated systems. The use of risk management as part of the validation process is also covered.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Explain the regulatory basis for validation and the role of validation within Good Manufacturing Practice.
2. Describe the major steps involved in the validation of critical pharmaceutical and medical device manufacturing operations, including equipment, process, cleaning and test method validation.
3. Appreciate the growing dependence on automated systems, software and data in a manufacturing context and the importance of equipment and automated system validation and data integrity.
4. Prepare a validation / qualification document and complete risk assessment exercises in accordance with regulatory guidelines and industry best practice.
5. Recognise opportunities for more sustainable practice within industry, specifically with respect to electronic record and data management.

Indicative Syllabus

Equipment validation – DQ, IQ, OQ, PQ.
 Validation of medical devices including clean room and sterilisation validation
 Computerised Systems and Good Automated Manufacturing Practice
 Data Integrity and the ALCOA principles
 Risk management and its role in validation including review of ISO 14971
 Pharmaceutical process validation, cleaning validation and analytical test method validation
 Key quality supporting processes, e.g. Change Control

Teaching and Learning Strategy

Delivery of the module will include lectures, group work, in class discussion and analysis. Guest industry speakers will be invited to present on specialist topics, e.g. Considerations for successful process and medical device product validation.

Flexible delivery including face to face, online or a combined blended methodology. Learning will be facilitated through group work, discussions, debate and peer learning.

The use of technology will enhance the teaching approach by facilitating additional means of communication as well as providing a suite of resources to support student learning.

When deploying the blended approach, a combination of face to face and online teaching will take into consideration the context of the topic, as well as alignment with other modules being delivered at the time.

Assessment Strategy

50% continuous assessment 50% final examination; Examples of assessment include validation documentation preparation, application of risk assessment tools, short in class quiz/exam, report preparation on specialist topics.

Repeat Assessment Strategies

Repeat exam available

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 50 % | | |
|--|----------------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Assessment | Knowledge quiz(es) & Reflections | 25 % | End of Semester | 1,2,3,4 |
| Group Project | Write a protocol / Test scripts | 25 % | Week 10 | 5 |

| End of Semester / Year Formal Exam: | | 50 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 50 % | End of Semester | 1,2,3,5 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|---------|-------------|---------------|-------|-----------|
| Lecture | Lecture | Not Specified | 3 | Weekly |

Required Reading Book List

Agalloco, P., Desantis, P., Grilli, A., Pavell, A., (2021). *Handbook of Validation in Pharmaceutical Processes Fourth Edition* . ISBN 0367754290 ISBN-13 9780367754297

Browne, P., (2017). *Commissioning, Qualification and Validation*. Createspace Independent Publishing Platform. ISBN 1547091258 ISBN-13 9781547091256

Wyn, S., (2008). *GAMP 5*. ISBN 1931879613 ISBN-13 9781931879613

Haider, S., Asif, S., (2010). *Cleaning Validation Manual*. CRC Press. ISBN 9781439826607 ISBN-13 1439826609

Schindwein, S., Gibson, M., (2018). *Pharmaceutical Quality by Design*. John Wiley & Sons. ISBN 9781118895207 ISBN-13 1118895207

Chan, C., (2004). *Analytical Method Validation and Instrument Performance Verification* . Wiley-Interscience. ISBN 0471259535 ISBN-13 9780471259534

Literary Resources

Andrews, J (2006) Validating pharmaceutical systems: good computer practice in life science manufacturing. CRC Publishing

Robert A. Nash and Alfred H. Wachter 2003, *Pharmaceutical Process Validation*, Marcel Dekker

A G Singh Rathore and Gail Sofer 2005, *Process Validation in Manufacturing of Biopharmaceuticals*, Taylor and Francis

Haider, SI & Syed AE 1010. *Cleaning validation manual: a comprehensive guide for the pharmaceutical and biotechnology industries*. CRC London.

Chan, C.C. 2004. *Analytical method validation and instrument performance verification*. Wiley Interscience, UK.

Journal Resources**Online Resources**

Food and Drug Administration www.fda.gov

Irish Medicines Board www.imb.ie

European Medicines Agency www.emea.europa.eu

International Council for Harmonization www.ich.org

Other Resources**Programme Membership**

| | | | |
|----------------------|-----------------------|-----------------------|-----------------------|
| Full Title | Quality Management II | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 05 |
| Delivery Mode | Semester 1 | Duration | Semester - (15 Weeks) |
| Grading Mode | Numeric/Percentage | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

Quality Management for the pharmaceutical, biopharmaceutical, medical device and healthcare industry.

Learning Outcomes

On completion of this module the learner will/should be able to:

1. Demonstrate a good knowledge of Quality management Systems required for Current Good Manufacturing practice (cGMP), Good Quality Control Laboratory practice, Validation, Regulatory bodies, Environmental, Health & Safety & Occupation regulations.
2. Assess and critically review work practices / facilities / equipment to ascertain compliance with various standards and the risk to safety of employees and processes.
3. Describe the concept of analytical method validation and its critical importance in biopharmaceutical and pharmaceutical QA and QC.
4. Participate in a quality management audits and make a meaningful contribution to a quality management role.
5. Prepare and implement a safety statement in compliance with E.U. Directives and National legislation.
6. Examine the principles of sustainability in the context of the regulated Biopharmaceutical, Pharmaceutical and Medical Device industries and assist in their implementation.

Indicative Syllabus

Quality Management:

Quality Systems: The evolution of Quality Systems, leading to Total Quality Management. Pharmaceutical Quality Management system, ISO 9001, ISO 45001, ISO 14000 Series Accreditation and ISO 13485. Quality Risk management, Risk assessment and Hazard Analysis, & ICH guideline Q9 on quality risk management i.e. Basic risk management facilitation methods (flowcharts, check sheets etc.); Hazard Analysis and Critical Control Points (HACCP); Hazard Operability Analysis (HAZOP); Failure Mode Effects Analysis (FMEA); Failure Mode, Effects and Criticality Analysis (FMECA); Fault Tree Analysis (FTA); Root Cause Analysis

Good laboratory Practice (GLP): ISO 17025, Laboratory Information Management Systems (LIMS).

Validation: Validation of Analytical Methods. Method Validation Protocols Validation of a new test method: Standard or Reference Methods Method Development. Specificity, sensitivity accuracy of the Method Calibration and validation of equipment, overview IQ, OQ, and PQ.

Good Manufacturing Practice (GMP): Regulation, Licences required in the Pharmaceutical industry; EU GMP Guidelines Volume 4. FDA CFR 210 and 211. The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH). Auditing; ISO 19011:2018. Qualified Person.

Regulatory Affairs: HPRA, EU and US Regulatory bodies; regulations for pharmaceuticals and biopharmaceuticals.

Environment Health and Safety & Sustainably : Health and Safety Authority, Health and Safety Legislation and Workplace Regulations; Chemical and Biological agents, Hazard Identification and Risk Assessment in the laboratory; European Chemicals Agency (ECHA), REACH, Safety Data Sheet and Safety Statements. Integration Pollution Control & waste licences required.

Principles of sustainability: Learning how standards incorporate sustainable development goals (SDGS) and how they impact on the pharmaceutical and biopharmaceutical sectors. How ISO Standards help meet the SDGS e.g incorporation of ISO 45001-Goal 8: Decent work and Economic Growth & ISO 14000 QMS Goal 13: Climate Action. Others e.g Use of single use plastics versus stainless steel or glass, waste generation and disposal. Reduce reuse and recycle and look at and researching new and creative solutions being implemented by industry to achieve standardisation.

Teaching and Learning Strategy

(Lectures, in class activities using critical thinking and problem-solving exercises and self-directed learning on resources provided.

Assessment Strategy

Continuous assessment 30% of final grade (**must pass**) divided into 2 tasks as follows :

- Assignment Tasks by engaging in class activities and self-directed learning on appropriate content and resources provided 20%
- Theory CA 10%

Final written examination (2 hrs.); 70% of final grade (**must pass**)

To be awarded a pass in this module a candidate must achieve a minimum of 35% in the overall course work and the final exam elements of the module. If the mark of the overall course work or the final exam falls below 35% then the result for the module will be reviewed.

As a consequence, the result for the module will be entered as a failed element (FE).

To achieve greater than 35% in the failed element (FE), the candidate will have to carry out further work at the discretion of the programme board or avail of the repeat exam in Autumn.

Repeat Assessment Strategies

Repeat formal end of year exams are set for repeat students. Repeat CA may be offered depending on the circumstances pertaining to the repeat.

Additional Facilities

| Indicative Coursework and Continuous Assessment: | | 30 % | | |
|--|---------------------------------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Course work Assignments and theory CA | 30 % | OnGoing | 1,2,3,4,5,6 |

| End of Semester / Year Formal Exam: | | 70 % | | |
|-------------------------------------|------------|---------|-------------------|-------------------|
| Form | Title | Percent | Week (Indicative) | Learning Outcomes |
| Closed Book Exam | Final Exam | 70 % | End of Semester | 1,2,3,4,5,6 |

Full Time Delivery Mode:

| Type | Description | Location | Hours | Frequency |
|---------|-------------|-----------------|-------|-----------|
| Lecture | Lecture | Lecture Theatre | 2 | Weekly |

Required Reading Book List

Bunn, P., (2019). *Good Manufacturing Practices for Pharmaceuticals*. Drugs and the Pharmaceutical Sciences. ISBN 1498732062 ISBN-13 9781498732062

Anjaneyulu, Y., Marayya, R., (2018). *Quality Assurance and Quality Management*. Pharmamed Press. ISBN 9352300734 ISBN-13 9789352300730

Geigert, J., (2019). *The Challenge of CMC Regulatory Compliance for Biopharmaceuticals*. Springer. ISBN 9783030137540 ISBN-13 3030137546

, S., , B., , R., , L., , U., (2017). *21c Quality Management in the Pharmaceutical Industry*. ISBN 3871934577 ISBN-13 9783871934575

Welty, G., (2013). *Quality Assurance*. Elsevier. ISBN 9781908818621 ISBN-13 190881862X

Recommended Reading Book List

Rodriguez, J., (2015). *CAPA in the Pharmaceutical and Biotech Industries*. Elsevier. ISBN 9781908818379 ISBN-13 1908818379

Smart, J., (2013). *Lean Biomanufacturing*. Elsevier. ISBN 9781908818409 ISBN-13 1908818409

Prez, J., (2017). *Quality Risk Management in the FDA-regulated Industry*. ISBN 0873899482 ISBN-13 9780873899482

Dale, G., van der Wiele, T., van Iwaarden, J., (2013). *Managing Quality*. John Wiley & Sons. ISBN 9781118762172 ISBN-13 1118762177

Hout, A., (2021). *Sterile Manufacturing*. CRC Press. ISBN 0367754355 ISBN-13 9780367754358

Literary Resources

Journal Resources

As per moodle.

ISO Standards ISO 9001, ISO 14000, ISO 45001, ISO 17025, ISO 19011:2018

The Health Products Regulatory Authority (HPRA)

FDA CFR 210 & 211

Eudralex Volume 4 GMP

The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH)

PDA Journal of pharmaceutical Science and Technology

The Pharmaceutical Journal

Online Resources

As per moodle.

i2i National Standards in the library.

https://ec.europa.eu/health/documents/eudralex/vol-4_en

<https://www.pda.org/>

<https://www.fda.gov/drugs/pharmaceutical-quality-resources/current-good-manufacturing-practice-cgmp-regulations>

<https://www.pharmaceutical-journal.com/>

<https://www.hpra.ie/>

Other Resources

As per moodle.

Programme Membership

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| Full Title | Placement | | |
| Status | Draft | Start Term | 2024 |
| NFQ Level | 07 | ECTS Credits | 30 |
| Delivery Mode | Semester 2 | Duration | Semester - (15 Weeks) |
| Grading Mode | Pass/Fail | Failed Element | No |
| Department | Life Sciences | | |
| Module Author | Eugene McCarthy | | |
| Co Authors | Neville McClenaghan | | |

Module Description

Students are placed in an appropriate organisation in order to complete a six month work placement. Placements must be approved by the academic placement supervisor prior to commencement. The student will be placed under the guidance of a placement supervisor from the host company. This placement will provide the opportunity for each student to gain practical experience in a real-life setting.

Students alternatively can enrol in an Erasmus exchange programme with an appropriate academic institution subject to approval by the programme board.

An Academic placement may also be carried out at ATU Galway when facilitation at an external setting is not possible. Alternatively a hybrid model may be employed involving a combination of external and internal opportunities.

Learning Outcomes

On completion of this module the learner will/should be able to:

| | |
|----|--|
| 1. | Illustrate the organizational structure of the host company. |
| 2. | Describe the regulatory working environment of the company, including the basis of the company's GMP, validation and health and safety procedures. |
| 3. | Communicate effectively with other staff. |
| 4. | Organise workload and set priorities. |
| 5. | Discuss the importance of quality management. |
| 6. | Have significantly contributed to the achievement of one or more of the industry's production, quality, regulatory or other objectives. |
| 7. | Critically evaluate their placement experience in terms of personal development and assess the effect of their placement experience on their future career prospects |

Indicative Syllabus

Learners will be assigned to a relevant company by the placement co-ordinator during term 2 of year 3. Placement will occur in industry under the guidance of an industrial mentor and the placement co-ordinator.

Learners placed in industry will work for approximately 6 months. They will be employed in one section of the company, e.g. process development, or get an opportunity to work in a number of different sections. Such areas may include production, research and development, quality control, quality assurance, regulatory affairs.

Learners will be expected to apply the theoretical and practical knowledge that they have gained over the previous three years to their role in the company. It is expected that they will be given individual responsibility and that they will have set targets to meet within the company.

Learners can expect to complete the following training as part of their placement:

Training in Good Manufacturing Practice and in Health and Safety procedures.

Organisation of workload and use of company communication facilities.

Performance/observation of a range of activities within the company.

Teaching and Learning Strategy

Teaching and learning on this module takes place in two stages as follows:

Stage 1 Workshops : these workshops will be delivered prior to placement collaboratively by the Careers Office and an academic staff member. All students will complete their CV and do a formal mock interview.

Stage 2 : The Work Placement: Learning in the workplace will be 'on the job learning/training' supported by the academic supervisor and an industrial mentor. The student will use reflective learning to gain insight into skills developed in the workplace.

Assessment Strategy

This is a pass/fail module

Placement Logbook (Learning Journal)

A detailed logbook will be used for the purpose of recording training and competency. The logbook will form an accurate record of each learners training experience and will.

Placement report

Students will submit a report at the end of their placement. Full details on what information to include in the report is available in the placement handbook.

Host company assessment

Overall assessment of the learner's performance during placement will be recorded by an interview with the host company supervisor and an academic staff member. The questionnaire template used for the company evaluation is available in the placement handbook

Interview assessment

At the end of the placement, the student will present to academic staff and peer outlining the knowledge, skills and competence gained during their placement.

Repeat Assessment Strategies

The student must pass each element of the assessment. Any failed element must be repeated in early September.

If a student has failed to engage with their placement while on site in industry the student will be required to find another placement and repeat the entire placement.

Additional Facilities**Indicative Coursework and Continuous Assessment:**

%

| <i>Form</i> | <i>Title</i> | <i>Percent</i> | <i>Week (Indicative)</i> | <i>Learning Outcomes</i> |
|----------------------|--|----------------|--------------------------|--------------------------|
| Assessment | Placement Performance Grade, marked by industrial mentor | 20 % | OnGoing | 1,2,3,4,5,6,7 |
| Written Report/Essay | Placement Report, marked by academic supervisor | 40 % | End of Semester | 1,2,3,4,5,6,7 |
| Assessment | Placement Presentation | 40 % | End of Semester | 1,2,3,4,5,6,7 |

Full Time Delivery Mode:

| <i>Type</i> | <i>Description</i> | <i>Location</i> | <i>Hours</i> | <i>Frequency</i> |
|-------------|-------------------------|-----------------|--------------|------------------|
| Supervision | Placement Co-ordination | Not Specified | 3 | Weekly |

Required Reading Book List

Fanthome, C., (2004). *Work Placements - A Survival Guide for Students*. Red Globe Press.
ISBN 1403934347 ISBN-13 9781403934345

Davies, W., Dunn, K., (2011). *Communication Skills*.
ISBN 0273729527 ISBN-13 9780273729525

Mongan, J., Kindler, N., Gigure, E., (2018). *Programming Interviews Exposed*. John Wiley & Sons.
ISBN 9781119418474 ISBN-13 111941847X

Bolton, G., Delderfield, R., (2018). *Reflective Practice*. SAGE Publications Limited.
ISBN 1526411695 ISBN-13 9781526411693

Faust, B., Faust, M., (2006). *Pitch Yourself*. Pearson Education.
ISBN 0273707302 ISBN-13 9780273707301

Literary Resources**Journal Resources****Online Resources**

GMIT careers Office - [GMIT Careers Service | GMIT | Galway Mayo Institute of Technology](#)

CV Evaluation Tool: [CareerSet - Login to your Account](#)

Other Resources**Programme Membership**