1. **Title of the module**

BIOS8520 (BI852) – Advanced Analytical and Emerging Technologies for Biotechnology and Bioengineering

1. **Division or partner institution which will be responsible for management of the module**

Division of Natural Sciences

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 7

1. **The number of credits and the ECTS value which the module represents**

30 Credits (15 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Spring

1. **Prerequisite and co-requisite modules**

None

1. **The course(s) of study to which the module contributes**

Compulsory for MSc Biotechnology and Bioengineering

Optional for MSc Biomedicine

1. **The intended subject specific learning outcomes.
On successfully completing the module students will be able to:**

8.1 Demonstrate broad knowledge and understanding of key analytical technologies used in the analysis of cell-based expression systems in the biotechnology and bioengineering field.

8.2 Demonstrate practical experience of modern analytical technologies utilised in academia and industry in the field.

8.3 Display a fundamental understanding of the principles underlying spectroscopic, chromatographic, sequencing, microscopy, and physical methods of analysis.

8.4 Demonstrate confidence when interpreting data from analytical analysis of products and samples.

8.5 Demonstrate an assured ability to design appropriate analytical experiments to answer questions to be addressed.

8.6 Demonstrate an appreciation of the importance of analysis for quality assurance, process monitoring and fundamental understanding of biological systems.

1. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**

9.1 Demonstrate an ability to organise information clearly, present information, and adapt presentation for different audiences including academic and industrial.

9.2 Demonstrate confidence in interpreting data, marshal information from published sources, critically evaluate their own research and that of others.

9.3 Demonstrate effective time and workload management in order to meet personal targets and imposed deadlines.

9.4 Demonstrate use of appropriate technology to retrieve, analyse and present scientific information.

1. **A synopsis of the curriculum**

This module considers key areas of analytical technologies used for the analysis of proteins, small molecules and cells. This will include mass spectrometry techniques (GC-MS, ESI-MS, MALDI-ToF MS), crystallography and NMR, spectroscopy (UV-vis, IR, Raman, fluorescence, ESR), chromatography, DNA and RNA sequencing, bioinformatics, microscopy (AFM, EM), electrophoresis, (qRT)-PCR, ‘omics’ approaches, glycosylation profiling, cell based assays, simple fermentation control and measurements. Industrial case studies will be covered to demonstrate how different techniques and approaches are integrated in a commercial environment. Students will also be expected to design and implement a protocol aim at recovering and characterising a protein molecule from mammalian cell culture within set constraints and parameters. There will also be a visit to an industrial analytical laboratory to demonstrate such technologies in the work place. This will be delivered through workshops and seminars by specialists within the Industrial Biotechnology Centre (IBC) and involve a number of course work assignments that will consider the most current research and thinking in these areas. This will be complemented by a one week practical where the students are asked to design a process to purify and characterise a molecule and then use this to setup a crystallisation screen.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

The reading list will largely be the latest review and primary research articles in this area, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases, they will be set tasks for receiving appropriate journal articles to which we already have access. Key Journals will be Nature Biotechnology, Analytical Chemistry, Analytical Biochemistry, Biotechnology and Bioengineering, and Genetic Engineering News to which the students can subscribe free of charge. Many basic biochemistry and chemistry textbooks within the Library also cover much of the material which will be delivered.

1. **Learning and teaching methods**

Total Contact Hours: 60

Total Private Study Hours: 240

Total Study Hours: 300

1. **Assessment methods**
	1. Main assessment methods
* Data Handling and Interpretation (6-10 pages, including calculations/data handling/supporting material) – 25%
* Practical and Write-up (approx. 6 pages, including tables and figures)– 30%
* Presentation (10 minutes) – 25%
* In-Course Test (45 minutes) – 20%

13.2 Reassessment methods

* Like for like
1. ***Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)***

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *8.5* | *8.6* | *9.1* | *9.2* | *9.3* | *9.4* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Workshop | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Practical | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Guest Lecture | **x** |  | **x** | **x** |  | **x** |  | **x** |  |  |
| Site Visit | **x** |  | **x** |  | **x** | **x** | **x** | **x** |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |
| Data Handling and Interpretation | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Practical | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Presentation | **x** |  | **x** |  | **x** | **x** | **x** | **x** | **x** | **x** |
| ICT | **x** |  | **x** |  |  | **x** | **x** |  |  | **x** |

1. **Inclusive module design**

The Division recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Biosciences is an international discipline. This module presents subject-specific knowledge, research approaches and techniques, generated, developed and refined by scientists around the world. Mastery of the learning outcomes will equip students to apply the theories and techniques of the module in a wide range of international contexts. In compiling the reading list, consideration has been given to the range of texts that are available internationally and a selection has been identified to complement the delivery of the material. The Division of Natural Sciences is an international community of students and staff. Group activities e.g. in practicals, tutorials, workshops and self-study will naturally draw on the international make-up of the student body; the module teaching team includes members with international experience of teaching and research collaboration. Academics involved in international research projects will also use examples of such research in their research led teaching sessions.

**DIVISION USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

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| Date approved | Major/minor revision | Start date of delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 09/01/2019 | Minor | September 2019 | 7 | No |
| 20/11/20 | Minor | September 2021 | 13-14 | No |

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| Revised FSO Jan 2018 |