The Hong Kong University of Science and Technology

UG Course Syllabus

Introduction to Omics Technologies

BIEN4000D – Spring 2026

3 Credits

Pre-requisite: BIEN2610 OR LIFS2210

Instructor Name: LINARDI, Darwin

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Office Hours: By appointment

Course Description

This course introduces students to the high-throughput bioanalytical methods, commonly known as "omics" technology, specifically genomics, transcriptomics, proteomics, and metabolomics. This course is designed for students with a basic understanding of basic molecular biology and biochemistry. The course will cover the development, working principles and the experimental and computational workflows of nucleic acid sequencing platforms and biological mass spectrometry, as well as applications of these critical tools in biological research and medicine.

Intended Learning Outcomes (ILOs)

1. Explain the fundamental concepts and terminology associated with genomics, transcriptomics, proteomics, and metabolomics.
2. Describe the working principles behind various omics technologies, including nucleic acid sequencing and biological mass spectrometry.
3. Utilize bioinformatics tools and data analysis pipelines to analyze and interpret omics datasets effectively.
4. Propose appropriate experimental designs using omics technology to solve biological problems.
5. Develop an appreciation of omics technologies' impact on life science research and clinical practice.

Assessment and Grading

This course will be assessed using criterion-referencing, and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)
Assignment	20%
Quiz	10%
Group Project	20%
Midterm exam	25%
Final exam	25%

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Assignment	CILO-1,3	The in-class assignment will guide the students in the use of various omics data analysis pipeline.
Quiz	CILO-1-2	Short quizzes will test the student's understanding of the fundamental concepts of the course.
Group Project	CILO-2-5	The students will learn how omics is applied in various areas of healthcare and biomedical engineering.
Midterm exam	CILO-1-4	Tests foundational knowledge and application of genomics and transcriptomics data.
Final exam	CILO-1-4	Tests foundational knowledge and application of proteomics and metabolomics data.

Grading Rubrics

BIEN4000D - Final Presentation Rubric: Omics applications in healthcare and biomedical engineering

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Limited (2)	Poor (1)	Unsatisfactory (0)
Core Technology (40%)	Explains the omics technique and mechanism accurately and in depth; clearly describes how raw data are generated or utilized, using appropriate terminology and effective visuals.	Mostly accurate explanation with minor gaps; main steps of data generation/processing are described but with limited detail or clarity.	Basic description of the technique with several missing details or oversimplifications; data workflow only partially explained.	Important elements of the mechanism or workflow are unclear or incorrect; explanation is difficult to follow.	Largely inaccurate, superficial, or confused explanation; does not meaningfully describe how the technique works or how data are obtained.	No meaningful explanation of the technique or mechanism, or content is off-topic/absent.
Contribution of omics to the field (25%)	Clearly compares omics approaches with traditional methods; articulates specific advantages, limitations, and well-chosen examples in healthcare or biomedical engineering.	Provides a reasonable comparison with some mention of benefits or limitations; examples are present but not fully developed.	Mentions omics benefits in general terms with little explicit comparison to traditional methods; examples are minimal or vague.	Very limited discussion of contribution; statements are generic, with unclear or irrelevant examples.	Little or no explanation of how omics contributes beyond traditional methods; examples are missing or incorrect.	No discussion of omics contribution, or content is unrelated to the field.
Recent advancements in the field (15%)	Integrates multiple recent, high-quality studies or applications; synthesizes findings and explains their impact on practice or research.	Uses recent references and describes key findings, though links to impact are somewhat limited.	Cites one or two recent works but mainly lists findings without analysis or clear relevance.	References are few, weak, or not clearly recent; impact on the field is barely discussed.	Advances are outdated, incorrectly described, or largely missing.	No mention of recent work or advances.
Overall Clarity of Presentation (25%)	Presentation has a clear storyline, strong logical flow, and well-designed slides; delivery is clear, engaging, and within time.	Generally well organized and understandable with minor issues in flow, slide design, or timing; delivery is mostly clear.	Organization is uneven; main ideas can be followed but transitions, slides, or timing cause some confusion.	Poor organization; frequent jumps in logic, cluttered or sparse slides, or noticeable timing problems that hinder understanding.	Very disorganized and hard to follow; slides and delivery seriously impede comprehension.	Presentation not delivered, or so incomplete/disorganized that it cannot be evaluated.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates comprehensive understanding of omics concepts and technologies; accurately analyzes and interprets raw and processed omics data; clearly explains how findings translate to healthcare and biomedical engineering applications and critically reflects on omics impact.
B	Good Performance	Shows broad and accurate knowledge of omics; correctly performs basic analyses and interprets key outputs; applies results to relevant healthcare or biomedical engineering examples with generally clear explanation of omics significance.
C	Satisfactory Performance	Displays adequate understanding of core omics ideas; can carry out simple analyses with guidance and interpret main trends; relates results to omics applications at a basic level, though explanations may lack depth or precision.
D	Marginal Pass	Shows partial and sometimes incorrect understanding of omics; struggles with straightforward analyses or misinterprets outputs; connections between data and applications are vague or incomplete, but minimal requirements are met.
F	Fail	Lacks fundamental understanding of omics concepts and technologies; unable to perform or interpret simple omics analyses; cannot meaningfully relate data to healthcare or biomedical engineering applications and does not meet minimum standards.

Course AI Policy

ChatGPT, Poe, etc. can be used to refine your own writing and presentation or help you learn. They should not be used to complete your assignments for you.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, e.g., strengths, areas for improvement]. Students who have further questions about the feedback, including marks should consult the instructor within five working days or the announced deadline, whichever is earliest, after the feedback is received.

Resubmission Policy

Only the latest work submitted by the deadline will be graded. Submissions after the deadline will be subject to grade penalties without valid reasoning.

Required Texts and Materials

No specific texts required.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.