DEREE COLLEGE SYLLABUS FOR: BIO 4641 Advanced Topics in Bioinformatics	3/2/4
(New: Fall 2026)	**UK LEVEL : 6** **UK CREDITS: 20**
PREREQUISITES:	MA 2025 Applied Statistics for Sciences **or** MA 2021 Applied Statistics ITC 2088 Introduction to Programming **or** ITC 1070 Information Technology Fundamentals BI 1000 Introduction to Biology I BI 1101 Introduction to Biology II BI 3204 Human Genetics BMS 4530 Bioinformatics and Health Information Systems
CATALOG DESCRIPTION:	Covers the algorithmic foundations of computational biology, combining theory with practice. Principles of algorithm design, influential problems and techniques, and analysis of large-scale biological datasets. Topics include genomics (sequence analysis, gene finding, RNA folding, genome alignment and assembly, database search), transcriptomics (gene expression analysis, regulatory motifs, biological network analysis), proteomics and metagenomics.
RATIONALE:	The course provides students with a systems framework for understanding genomics, biomedical and healthcare informatics applications. The course focuses on advanced methodologies of bioinformatics research. The knowledge and skills presented in this course will help students to become well rounded bioinformaticians that can quickly be productive in any professional or academic setting.
LEARNING OUTCOMES:	*As a result of taking this course, the student should be able to:* 1. Analyse advanced bioinformatics methods and algorithms. 2. Explore advanced bioinformatics topics including transcriptomics, proteomics, metagenomics, epigenomics, structural bioinformatics etc. 3. Analyse, interpret and present the results of large-scale biological datasets. 4. Critically evaluate advanced bioinformatics studies, considering both methodological and ethical perspectives.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Class lectures, interactive learning (class discussions, group work) audiovisual presentations and other practical problems solved in class. • Exercises and primary source documents are assigned as homework, the solutions of which are reviewed in class. • Office hours held by the instructor to provide further assistance to students. • Use of library facilities for further study and preparation for the exams • Use of the Blackboard course management platform to further support communication, by posting lecture notes, assignment instruction, timely announcements, formative quizzes and online submission of assignments.
ASSESSMENTS:	Summative:

	<table><tr><td>1st assessment: Midterm examination (2 hours) Includes questions on topics covered through the lectures and questions on a scientific article.</td><td>30%</td></tr><tr><td>2nd assessment: Portfolio of student work and oral assessment</td><td>10%</td></tr><tr><td>Final assessment: Individual literature review project regarding a bioinformatics related topic (~ 4000 words).</td><td>60%</td></tr></table> **Formative:** <table><tr><td>Online quizzes, coding exercises and take-home problems throughout the course.</td><td>**0**</td></tr></table> The formative assessments and the portfolio assignments aims to prepare students for the summative assessments. The midterm examination tests Learning Outcomes 1,2 and 4. The final assessment tests all Learning Outcomes and it is comprehensive. *The final grade for this module will be determined by averaging all summative assessment grades, based on the predetermined weights for each assessment. If students pass the comprehensive assessment that tests all Learning Outcomes for this module and the average grade for the module is 40 or higher, students are not required to resit any failed assessments.*
INDICATIVE READING:	**REQUIRED READING:** In class PowerPoint presentations Bioinformatics and Functional Genomics by Jonathan Pevsner, 3rd Ed, ISBN-13: 978-1118581780 Bioinformatics - A Practical Guide to Next Generation Sequencing Data Analysis by Hamid Ismail. ISBN: 9781000861709 **RECOMMENDED READING:** Ethical Issues in AI for Bioinformatics and Chemoinformatics. ISBN: 9781000996104 Other sources, including journal and newspapers' articles, research papers etc. recommended by the instructor throughout the semester.
INDICATIVE MATERIAL: *(e.g. audiovisual, digital material, etc.)*	**REQUIRED MATERIAL:** **N/A** **RECOMMENDED MATERIAL:** **N/A**
COMMUNICATION REQUIREMENTS:	N/A
SOFTWARE REQUIREMENTS:	MS Office and Blackboard CMS MS Teams

WWW RESOURCES:	N/A
INDICATIVE CONTENT:	• Transcriptomics • Proteomics and Mass Spectrometry Data Analysis • Structural Bioinformatics Advanced • Comparative and Population Genomics • Metagenomics • Epigenomics • Systems Biology • Single-Cell Genomics • Biological Network Analysis • CRISPR and Genome Editing Analysis • Big Data in Bioinformatics