DEREE COLLEGE SYLLABUS FOR:

CSC 3131 Theory of Computation **3/0/3**
(Fall 2025) **UK LEVEL: 5**
UK CREDITS 15

PREREQUISITES:	MA/ITC 2055 Discrete Mathematics
COREQUISITES:	None.
CATALOG DESCRIPTION:	Automata, languages and expressions, pumping lemmas**,** Turing machines, computability, decidability, complexity theory, complexity classes, problem reducibility.
RATIONALE:	The course introduces students to the theory of computation and complexity. Students will learn about automata used for expression parsing and language categorization, the use of Turing machines, time and space complexity classes, while they will also practice problem reducibility on NP-complete/hard problems.
LEARNING OUTCOMES:	As a result of taking this course, the student should be able to: 1. Use automata to identify regular expressions and context-free languages. 2. Demonstrate understanding of the use of Turing machines on decidable and undecidable problems. 3. Classify complexity classes and hard computational problems. 4. Apply polynomial reducibility.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Lectures, class discussions, use of generative AI tools to inform course content. • Office hours: Students are encouraged to make full use of the office hours of their instructor, where they can ask questions and go over lecture material. • Use of the Blackboard Learning platform, where instructors post lecture notes, assignment instructions, timely announcements, as well as additional resources.
ASSESSMENT:	Summative: 1st assessment: Midterm Examination Short problems. **30%** 2nd assessment: Portfolio of student work and oral assessment. **10%** Final assessment: Final Exam Answers to problems. **60%** **Formative:** Homework, In class quizzes **0%** The formative assessments aim to prepare students for the summative assessments and expose them to teamwork. The 1st summative assessment tests LOs 1, 2.

	The 2nd summative assessment tests LOs 1, 2, 3, 4. The final summative assessment tests LOs 1, 2, 3, 4. *The final grade for this module will be determined by averaging all summative assessment grades, based on predetermined weights for each assessment. If students pass the **final summative assessment,** which tests all Learning Outcomes for this module, and the average grade for the module is 40 or above, students are not required to resit any failed assessments.*
INDICATIVE READING:	**REQUIRED MATERIAL:** 1. Sipser, Michael. Introduction to the Theory of Computation. 3rd ed. Cengage Learning, 2012. ISBN: 9781133187790. 2. Instructor's notes. **RECOMMENDED READING:** 1. Anne Benoit, Yves Robert, Frédéric Vivien, A Guide to Algorithm Design: Paradigms, Methods, and Complexity Analysis, CRC press, 2013. ISBN 9781439898130
INDICATIVE MATERIAL: *(e.g. audiovisual, digital material, etc.)*	**REQUIRED MATERIAL:** N/A **RECOMMENDED MATERIAL:** N/A
COMMUNICATION REQUIREMENTS:	Daily access to the course's site on the College's Blackboard CMS. Use of word processing and/or presentation graphics software for documentation of assignments.
SOFTWARE REQUIREMENTS:	None
WWW RESOURCES:	Complete list of Theory of Computation topics, MIT https://www.youtube.com/playlist?list=PLUl4u3cNGP60_JNv2MmK3wkOt9syvfQWY
INDICATIVE CONTENT:	1. Introduction to Computability and Complexity 2. Automata and Regular Expressions 3. Push-down automata, Context-free grammars, Pumping lemmas. 4. Turing machines 5. Decidability and the halting problem 6. Complexity: Time and space measures of complexity 7. Complexity classes a. P, NP, co-NP, EXPTIME, PSPACE b. Example problems 8. Intractability and hard computational problems 9. Polynomial reducibility a. Overview b. Reducibility of NP-hard problems, SAT 10. Advanced topics in computation