PROGRAMA DA DISCIPLINA/TURMA 3ZB PERÍODO: 2025.1

MAT2425	**TÓPICOS DE FÍSICA MATEMÁTICA I** CARGA HORÁRIA TOTAL: 45 HORAS Nº CRÉDITOS: 3 PROFESSOR: Sergey Tikhomirov
TÍTULO DA DISCIPLINA:	Quantum Computing

OBJETIVOS DA DISCIPLINA/TURMA	Provide basic notions of quantum computing allowing understanding and developing algorithms for quantum computers
EMENTA DA DISCIPLINA	Quantum computers can be described by a relatively easy mathematical model based on linear algebra and probability theory. We show how entanglement allows having computational speed-up. At the same time some “easy” algorithms such as “adding 1” have nontrivial details. The most famous algorithms are quantum Fourier transform, Quantum search (Grover), Shor. In the course we consider them as well as more practical-related approaches such as Q-RAM and speeding up linear algebra (HHL-algorithm).
PRÉ-REQUISITOS DA DISCIPLINA	Linear algebra
PROGRAMA DA DISCIPLINA/TURMA	Representation of a state of quantum computer, Measurements. Operations on quantum computers. Quantum gates. What is a quantum program? String notation. Bka-ket notation. Calculations in basis. Single- and two-qubit gates. Permutations. Realizations of multiple-control. Quantum memory, QRAM algorithm. Quantum search, Grover algorithm. Quantum Fourier transform. Period-finding. Phase estimation. Introduction to the speed-up of linear algebra. HHL-algorithm including hamiltonian simulation, Mixed states, Density operator. No-clonning theorem. Noise channels. Operator-sum-representation. Trace distance and Fidelity.

AVALIAÇÃO DA DISCIPLINA	Critério 12 Média = G1
DETALHAMENTO AVALIAÇÃO DA DISCIPLINA	Answer to two theoretical questions and one program.
BIBLIOGRAFIA BÁSICA DA DISCIPLINA	Collin P. Williams. Explorations in Quantum Computing, 2011. Michael A. Nielsen, Isaac L. Chuang. Quantum Computation and Quantum Information. 2010
BIBLIOGRAFIA COMPLEMENTAR DA DISCIPLINA	Danial Dervovic, Mark Herbster, Peter Mountney, Simone Severini, Naïri Usher, Leonard Wossnig, Quantum linear systems algorithms: a primer, 2018,
BIBLIOGRAFIA DE PESQUISA DA DISCIPLINA	