# Exam 3

Course Title:        **Taller de Traducción Ingeniería y Adelantos Tecnológicos**
Course ID:           **IT0628 (Marron, 25-2)**
Cohort ID:           **6A1**
Exam Date:           **08 Apr 2025**

**General Instructions:** Print your name in the upper right-hand corner of this paper. Read each item carefully. Be sure that you understand exactly what is being asked of you. Begin your answers on the backside of this paper if possible and add extra sheets of paper as needed. Be sure to write your name on any and all extra sheets of paper. Staple all exam papers together when you are finished.

Do not look at other student's exams. If you have a question or a request during the exam, raise your hand and the instructor will call on you.. Do not leave your desk without permission. If you finish early, raise your hand and the instructor will call on you.

This is a closed book exam, however, you may reference your final homework assignment. Attempt to answer all questions, even if you are uncertain. Whenever possible, provide answers in bullet list format with complete content. Tasks will be evaluated by sub-tasks. Three (3) points are available for each sub-task: Accuracy (1 pt), Completeness (1 pt), and Sufficiency (1 pt). Points will be awarded in 0.1 increments. Answer in English unless requested to do so otherwise.

## Task 1 (9 pts)
S. Subramaniam *et al* deliver a road map for the future of medicine that completely integrates, and in truth, absolutely depends on bioengineering (see S. Subramaniam *et al*., "Grand Challenges at the Interface of Engineering and Medicine," in *IEEE Open Journal of Engineering in Medicine and Biology*, vol. 5, pp. 1-13, 2024)

a) Define each of the five Grand Challenges at the interface of engineering and medicine.
b) Translate the following into Spanish:
> *The 21st century is witnessing a paradigm shift in human health and medicine. Engineering of entirely unforeseen devices, sensors and technologies has given rise to a deeper understanding of human physiology and pathophysiology. We are in the unprecedented position to translate the knowledge obtained from the multiscale myriad measurements into actionable outcomes and the Grand Challenges outlined here provide a roadmap for this future.*
c) Summarize the article's Conclusion in English.

## Task 2 (6 pts)
The guest editorial by Y. D. Zhang  notes that "weakly-supervised deep learning (WSDL) methods have emerged as a solution to alleviate the manual annotation burden for structured biomedical data like signals, images, and videos." (in Y. D. Zhang, "Guest Editorial Introduction to the Special Section on Weakly-Supervised Deep Learning and Its Applications," in *IEEE Open Journal of Engineering in Medicine and Biology*, vol. 5, pp. 393-395, 2024,)

a) Why would signals, images, and videos have a "high manual annotation burden" before the data they contain could be used in biomedical analysis?
b) What is weakly-supervised deep learning (WSDL)?

## Task 3 (6 pts)

Quantum computing is a reality although to date, impractical. Quantum computers have the potential to solve problems that are intractable for classical computers, such as simulating the behavior of matter, analyzing compounds for new drugs, and optimizing complex systems. In his perspective on quantum computing, Fauseweh, B states that "simulating quantum many-body systems is a key application for emerging quantum processors." Reaching this goal is a key piece in the quantum technology cycle (see Fauseweh, B. Quantum many-body simulations on digital quantum computers: State-of-the-art and future challenges. *Nat Commun* **15**, 2123 (2024).)

a) Briefly explain the quantum technology cycle as shown in the figure below.
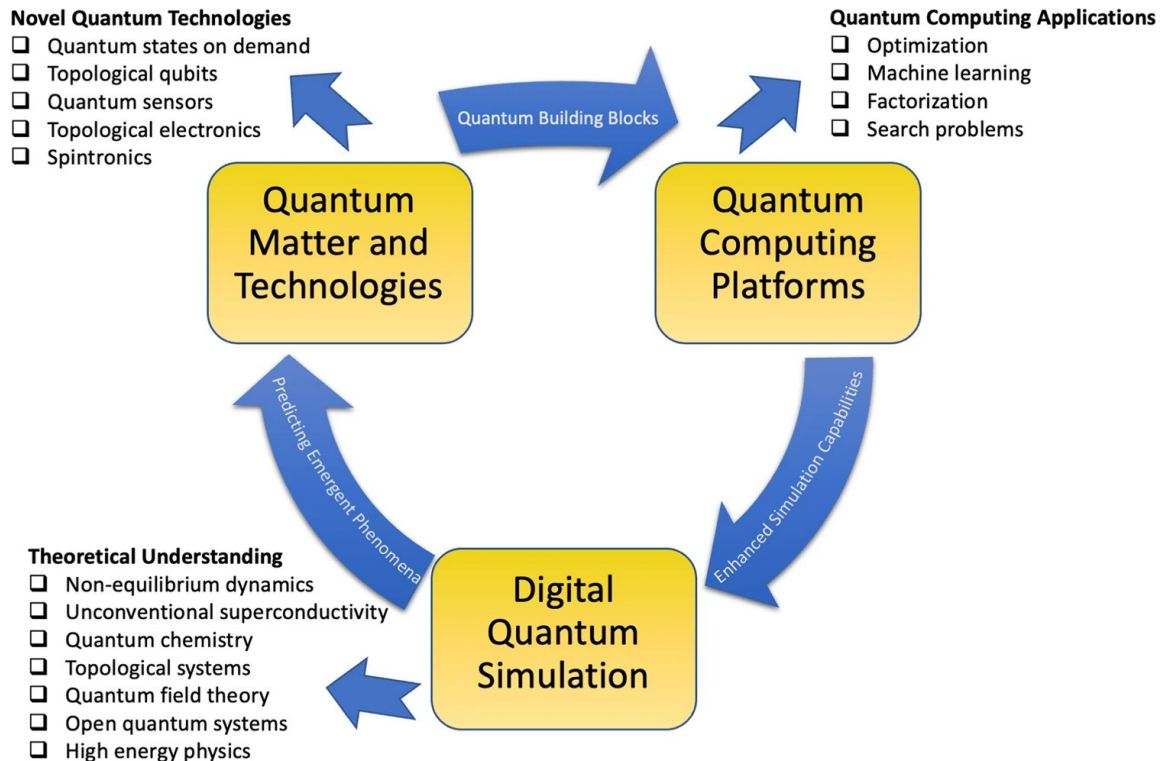


## Task 4 (9 pts)

Define the following terms in English and Spanish:
- analgesic
- bioinformatics
- CRISPR
- deleterious
- en vitro
- extrapolation
- homeostasis
- necrotic
- proliferation
- quantum
- synergistic
- vascular