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IT628 (Brown)

Terminología

Examen Final

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I. Foundations of Science and Engineering

Task 1 (3 pts)

a) Do you think scientific language is just professional jargon or, as Altieri Biagi suggests, do you think scientific language is the language of objective complex thought?

Scientific language goes beyond being mere professional jargon. As Altieri Biagi suggests, it is the language of **objective complex thought**. While it shares some traits with jargon, such as technical vocabulary, it also plays a crucial role in **constructing and communicating knowledge**. Scientific language allows us to describe reality in precise, systematic ways, making it essential for sharing research, forming hypotheses, and developing theories. Its purpose is not limited to professional circles; it influences education, policy-making, and public understanding of science. Therefore, scientific language must be seen as a **distinct linguistic variety** that reflects structured, objective thinking, rather than just a specialized code used among professionals.

Task 2 (3 pts)

a) Explain the concept of mental models and how they guide scientific inquiry.

Mental models are internal representations that people create to understand and simulate how things work in the real world. According to Johnson-Laird, these models help us **interpret sensory information**, **understand**

language, **predict events**, and **make decisions**. In science, mental models allow researchers to visualize complex systems, **form hypotheses**, and **simulate experiments mentally** before conducting them. They are fundamental for reasoning because they provide a flexible and structured way to explore different scenarios, test cause-effect relationships, and anticipate outcomes. As such, mental models are a **core cognitive tool** in the scientific method, supporting both theoretical development and practical problem-solving.

Task 3 (3 pts)

a) What are heuristics and how are they used in science?

Heuristics are informal rules or strategies that guide problem-solving and decision-making, often based on **experience or intuition**. In science, they help researchers **navigate complex problems** by suggesting plausible approaches or solutions without requiring exhaustive analysis. According to Lenat, heuristics act as **"compiled hindsight"**, shaped by patterns and regularities observed over time. They help scientists focus on productive areas of inquiry, avoid dead ends, and **generate new ideas efficiently**. For example, a biologist might use a heuristic like "structure implies function" when investigating an unknown organism. Though not always precise, heuristics are **powerful cognitive shortcuts** that enhance innovation and efficiency in scientific work.

Task 4 (9 pts)

a) Briefly explain the six fundamental laws of conservation.

1. **Conservation of Mass:** Mass is neither created nor destroyed in a closed system during any physical or chemical process.
2. **Conservation of Energy:** Energy cannot be created or destroyed; it can only change from one form to another.
3. **Conservation of Linear Momentum:** The total linear momentum of a closed system remains constant unless acted upon by external forces.

4. **Conservation of Angular Momentum:** If no external torque acts on a system, its angular momentum remains constant.
5. **Conservation of Charge:** The total electric charge in an isolated system remains constant over time.
6. **Conservation of Baryon Number:** In particle physics, the number of baryons (like protons and neutrons) remains constant in interactions.

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b) System Study Example:

Selected System: *A solar water heating system used in a household.*

i) **Is the system open or closed?**

Open system — it exchanges both energy (heat) and matter (water) with its surroundings.

ii) **What are the boundaries of the system?**

The physical boundaries include the solar panel, water pipes, storage tank, and valves.

iii) **What are the surroundings of the system?**

The outdoor environment (sunlight, air), the building it serves, and the electrical power source if used for auxiliary heating.

iv) **What types of energy/materials flow into and/or out of the system?**

- **In:** Solar radiation (energy), cold water (material).
- **Out:** Heated water (material), heat loss to air (energy).

v) **What measurements will you make on the system?**

- Inlet and outlet water temperatures
- Solar irradiance levels
- Water flow rate

- Energy efficiency
- Pressure inside the pipes

Task 5 (3 pts)

a) How does Mackay diagram verbal communication?

i) **Signal generator:** The **speaker's brain**, which formulates the message.

ii) **Communication channel: Air and sound waves** that transmit the spoken message.

iii) **Message receiver:** The **listener's brain**, which interprets the signal into meaningful information.

II. Translation of Research Papers

Task 6 (9 pts)

a) Which sections of a research paper are most useful to the professional translator? Why?

The **abstract**, **introduction**, and **conclusion** are most useful because they summarize the purpose, scope, and findings of the paper, offering context for the technical terminology. The **methods and results** sections are also critical since they contain specific procedures and data that must be translated precisely for replication or understanding.

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b) Spanish Translation of Excerpt:

Este artículo presenta una investigación exhaustiva sobre el papel de la variación en la permeabilidad del suelo en la estabilidad de taludes reforzados con muros de contención, enfocándose en el caso de estudio del deslizamiento en Huizhou. El estudio demuestra que el aumento en los niveles freáticos reduce el Factor de

Seguridad (FoS) de los muros de contención, siendo la estabilidad más comprometida bajo cargas combinadas del suelo adyacente y del concreto ligero. Estos hallazgos enfatizan la necesidad de mejorar el drenaje o el soporte estructural en los diseños de muros de contención expuestos a condiciones de agua subterránea elevada. Se integran simulaciones numéricas avanzadas, utilizando Abaqus y GeoStudio, con datos empíricos de campo para analizar las interacciones entre la permeabilidad del suelo, la presión intersticial, el contenido de humedad, la resistencia al corte y la estabilidad general del talud. La dinámica de infiltración del agua está influenciada por la permeabilidad, el contenido de humedad y el nivel freático. Estos factores cambian la presión intersticial y disminuyen la resistencia al corte, lo que provoca fallas por corte en la masa del talud. Esta investigación también analiza cómo la carga de sobrepeso afecta la estabilidad del talud. Los suelos con mayor permeabilidad provocan tasas de infiltración más rápidas, generando presiones intersticiales más altas, resistencias al corte efectivas más bajas y una mayor probabilidad de falla del talud. Lo contrario ocurre con la baja permeabilidad, que dificulta el drenaje y finalmente genera una acumulación de presión hidrostática detrás de los muros de contención, lo que a su vez hace que el talud sea aún más inestable. Este estudio demuestra la necesidad crítica de sistemas de drenaje optimizados para reducir los riesgos de fallas inducidas por infiltración y el papel de una evaluación precisa de la permeabilidad en el diseño geotécnico. Los ingenieros geotécnicos pueden usar estos resultados para entender mejor cómo construir y mantener sistemas de estabilización de taludes.

III. Technology Futures in Mexico

Task 7 (3 pts)

a) Which engineering area will have the greatest impact for Mexico?

Semiconductor engineering is likely to have the greatest impact for Mexico. As global demand for semiconductors continues to grow, especially in areas like AI, automotive, and consumer electronics, Mexico has a unique opportunity to position itself as a hub for manufacturing and design. Strengthening this sector could enhance the country's technological independence, create high-value jobs, attract foreign investment, and boost collaborations with global tech leaders. It could also align with North America’s strategy to reduce reliance on Asian markets for chip production.

IV. Building Vocabulary

Task 8 (6 pts)

Word	**English Definition**	**Spanish Translation**	**Definición en español**
Accuracy	The degree of closeness to a true value	Precisión	Grado de cercanía a un valor verdadero
Catalyst	Substance that speeds up a chemical reaction	Catalizador	Sustancia que acelera una reacción química
Threshold	A point at which something begins or changes	Umbral	Punto donde algo comienza o cambia
Algorithm	A step-by-step procedure for solving a problem	Algoritmo	Procedimiento paso a paso para resolver algo
Gradient	A rate of inclination or slope	Gradiente	Tasa de inclinación o pendiente
Viscosity	A liquid’s resistance to flow	Viscosidad	Resistencia de un líquido a fluir
Isotope	Variants of a chemical element with different masses	Isótopo	Variante de un elemento con distinta masa

Word	English Definition	Spanish Translation	Definición en español
Load	Force or weight supported by a structure	Carga	Fuerza o peso que soporta una estructura
Turbulence	Irregular or chaotic fluid motion	Turbulencia	Movimiento de un fluido irregular o caótico
Equilibrium	A state of balance between opposing forces	Equilibrio	Estado de balance entre fuerzas opuestas