

# BIOMATERIALS

Spring Semester 2025 - 2026

## 2<sup>nd</sup> Assignment

Submission Date: Wednesday, May 13, 2026
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1. A hip implant may fail due to different mechanisms:

- Infection: 0.04
- Loosening: 0.06
- Fracture: 0.02
- Wear: 0.03

- a) Using the definition of **reliability**, calculate the reliability of each failure mode
- b) Determine the **total reliability** of the implant system
- c) Identify which failure mechanism most strongly affects overall performance

2. A ceramic implant has:

- Bulk density: 2.4 g/cm<sup>3</sup>
- Theoretical density: 3.0 g/cm<sup>3</sup>

- a) Calculate the **porosity** of the material
- b) Explain how porosity influences:

- mechanical strength
- biological integration (bone ingrowth)

3. Provide 3–4 examples of medical devices for each of the following cases and justify your choices:

- Cases where a hydrophobic surface is required, explaining why water repellency is important for the specific application.
- Cases where a hydrophilic surface is required, analyzing the role of interaction with water or biological fluids in the functionality of the device.