

## Biomedical Engineering B

The use of calculators is allowed in the exam.

1. Explain briefly (6p)

- a) Hydrophilicity
- b) Photo degradation
- c) Bulk erosion
- d) Crevice corrosion
- e) 316 L
- f) Single crystal material
- g) Osteoinduction
- h) Zirconia
- i) Block copolymer
- j) The degradation rate of the implant vs. the healing rate of the tissue
- k) Laminate
- l) Two way shape memory

2. a) What is bioactive glass, how and why it is used how does it interact with the tissue it is used with? (3P)
- b) How does a bioactive glass differ (material/use/interactions) from Hydroxypapatite ? (3P)
3. How do biostable and bioabsorbable polymers differ from each other? Also explain (use/interactions) and give examples of both. (6p)

4. Materials have the following mechanical properties. (5p)

	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation at break (%)	Elastic modulus (GPa)
Austenitic Nitinol	1200	600	30	110
Al <sub>2</sub> O <sub>3</sub>	1000	Not available	Not available	350
Cortical bone (longitudinal)	130	Not available	3	12.0

Draw a stress / strain curve of both materials, illustrating the points of action, based on the given data and the x-y guidelines as accurate as the data allows you to.

Use the following criteria: stress is at Y-axis 0 – 1500 MPa, Strain(%) at X-axis 0 – 10  
Y-axis 15cm, x-axis 10 cm

Strain =  $\Delta \text{length} / \text{Original length}$

Elongation% (Strain%) = strain \* 100%

5. Common biopolymers are listed below. Combine together the correct structural formula and name of the polymer. Discuss briefly about the nature of this polymer and mention also at least one application in which the polymer is used. (7p)

Polyglycolic acid (PGA,) Polycaprolactone, Polylactic acid (PLA), Chitosan, Poly(methyl methacrylate), Polyvinyl chloride, Polyethylene

