

BME final exam. 2009-06-11 closed book

Department: Student number: Name:

Note: () can consists of one or more words. There are a total of four pages.

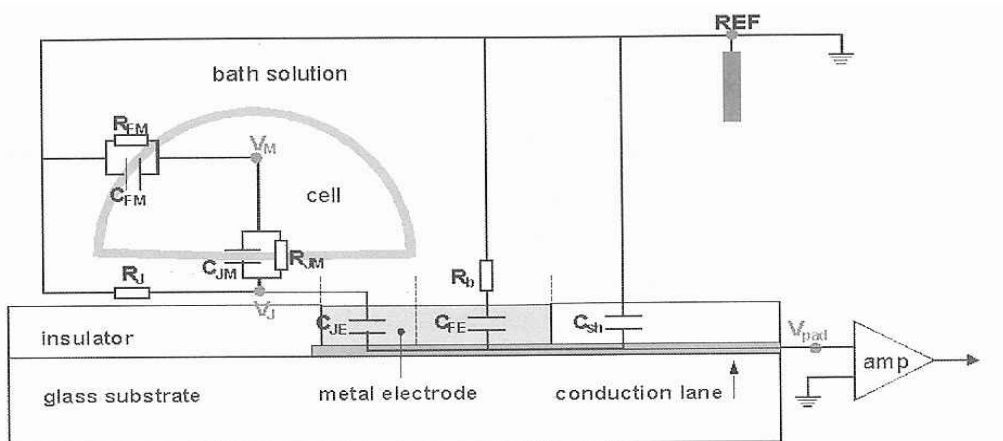
1. Answer the following questions regarding the Biomaterials.

- A. A minimum of 12% () is added to make steel “stainless”, but at a wrong concentration, it will reduce the corrosion resistance of the steel.
- B. The unfired ceramic is called a(n) (). After the sintering, the powder coalesces into a hard material. Then the sintered parts are machine-grinded into their final shape.
- C. () occurs when two dissimilar metals in electrical contact are immersed in an electrolyte – an anode, a cathode, an electrolyte, and an external electrical conductor are must. This limits the life time of the material.
- D. () is a normal reaction to the foreign body. It is the first response of any vascularized tissue to tissue damage. There are four cardinal signs associated with the inflammatory response.

2. Answer the following questions regarding the Tissue Engineering and the Two Laboratory works.

- i. Three classes of the Organ transplantation, classified depending on where the tissue was obtained are: (),(), ().
- ii. Micro-contact printing is a technique frequently used to form simple neural networks on microelectrode arrays (MEA's). Exact alignment of neuron cell body to an electrode site is desired for better recording of neural activity. (1) Explain two problems that occur when the cell body is misaligned and partially

covering the electrode surface. (2) To infer the problems, derive an equation that describes the relation between V_{pad} and V_J in the following diagram, which is drawn to illustrate the problem in (1). In the circuit model showing the neuron –electrode junction, R_b is negligible and $C_{sh} \ll C_E$,



- R_{FM}, C_{FM} : Free membrane resistance and capacitance
- R_{JM}, C_{JM} : Junction resistance and capacitance between cell membrane and electrode
- R_J : Sealing resistance
- C_{JE} : Capacitance of the covered electrode area of size a_{JE}
- C_{FE} : Free electrode capacitance
- C_E : Capacitance of the entire electrode area if size a_E ($C_E = C_{JE} + C_{FE}$)
- C_{sh} : Shunt capacitance of the connecting lane

4. (Artificial Vision) The following diagram shows the phosphenes position patterns obtained from a patient of the Belgium Optical Nerve Artificial Vision project. Based on this diagram, **Describe the functions of the Stimulation System** that let this patient recognize the shape of the things in front of her. She has four cathodic electrode contacts implanted around one of her two optic nerves and a reference anodic electrode contact placed nearby. By the Stimulation System, we mean the system that obtains images captured from a glasses- frame mounted camera worn by the patient and generates appropriate electrical stimulation pulses corresponding to the captured image that are applied to the electrode contacts.

