Tfy-99.4280 Medical Imaging Methods **Virtanen**

Problems for examination on January 19, 2010

- **You may answer in English, Finnish or Swedish**

1. Give brief definitions or descriptions of the following terms or concepts (in the context of this course):
   a) Time-gain compensation
   b) Penumbra
   c) Beam hardening
   d) RF coil
   e) SPECT
   f) Compton scattering

2. Describe A, M and B scanning modes in ultrasound imaging. For each mode, give an example of clinical application.

3. Contrast agents are used to improve image resolution in both X-ray imaging and MRI, but their use is based on completely different physical phenomena. Describe the physical basis for contrast agent use in these two imaging methods. Give an example of at least one contrast agent in each case.

4. How is the spin-echo (SE) sequence (Figure 1) used for image acquisition in MRI? How is the contrast between different tissues optimised?

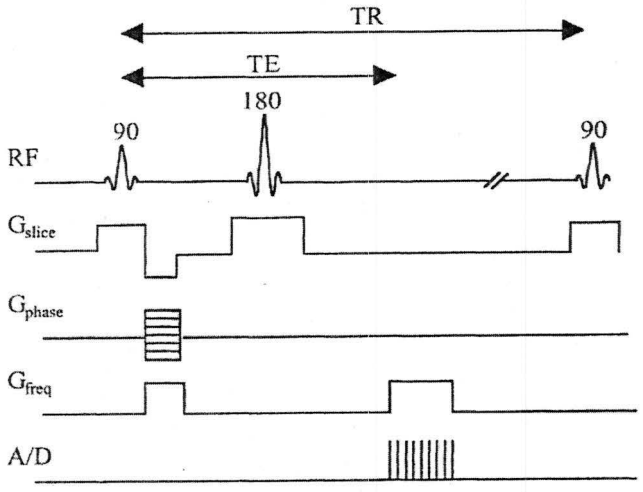

Figure 1: Spin-echo sequence.

5. The technetium generator produces ^{99m}Tc through the radioactive decay of ^{99}Mo via the decay chain

$$^{99}\mathrm{Mo} \xrightarrow{\lambda_1} {}^{99\mathrm{m}}\mathrm{Tc} \xrightarrow{\lambda_2} {}^{99}\mathrm{Tc},$$

where λ_1 and λ_2 are the decay constants of ^{99m}Tc and ^{99}Mo, respectively. Show mathematically that if $\lambda_1 << \lambda_2$, then the radioactivities of the parent and daughter nuclei become equal in value at long times.