

Final Examination

Physics and Analysis of Medical Images I – Spring 2005

Due: 2:00 PM, May 11, 2005

On my honor I have neither given nor received aid from any individual other than my instructor on this examination.

Printed name: _____ Signature: _____

Instructions: Pose at least one question, with appropriate answer(s), for each topic listed below. The questions and answers that you provide should demonstrate the level of your understanding of each topic. It is acceptable to be qualitatively descriptive, but to demonstrate a clear understanding of the physics, it will probably also be necessary to be quantitatively descriptive. Remember that graphs, figures, plots, tables, etc. are an effective way to provide data. You may use any written source (books, journals, etc).

You do not need to write extensively about each topic. Write clearly, with parsimony, and with focus. Write enough to answer each question completely, but no more. The assessment (grade) of the exam will be determined based on the depth of understanding illustrated in your responses for each topic. The assessment will not depend on the amount of text written for each topic, but rather the depth of understanding exhibited for each topic. Good luck.

Topic 1: The relationships between dose, kerma, exposure, effective dose, and equivalent dose.

Topic 2: The mechanism responsible for the relationship between TE and TR, and T1- and T2-weighted images in the spin echo magnetic resonant imaging technique.

Topic 3: The relationship between transverse slice thickness, bandwidth, gradient strength, Gibbs phenomenon, and re-phasing gradient.

Topic 4: Construction of k-space in MRI.

Topic 5: Relationship between SNR, bandwidth, and artifacts in MRI.

Topic 6: Scattering distribution in medical ultrasound.

Topic 7: The relationship between plane waves, reflection, refraction, attenuation, transmission, and plane surfaces.

Topic 8: Steering, scanning, and sweeping of a piezoelectric crystal, and the production of acoustic energy used in medical ultrasound.

Topic 9: The relationship between the pulse echo equation and either the Fresnel or Fraunhofer approximations.

Topic 10: The relationship between image-guided therapy, radiation, dose, and tumor location.

Topic 11: Make up your own topic and responses based on the material presented by Earl Nixon.