NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

SRA 3211 - ULTRA SOUND

BSc HONOURS PART III: MAY 2005 *DURATION: 3 HOURS*

ANSWER **ALL** PARTS OF QUESTION **ONE** IN SECTION A AND ANY **THREE** QUESTIONS FROM SECTION B. SECTION A CARRIES 40 MARKS AND SECTION B CARRIES 60 MARKS

SECTION A

1. (a) If the frequency of sound is changed from 5MHz to 7.5MHz, explain what happens to the propagation speed. [3]

(b) The rate of divergence of an ultrasound beam increases as the transducer element is:

i) increased in diameter
ii) decreased in diameter
iii) increased in thickness
iv) decreased in thickness [2]

(c) Scattering refers to:
(i) bending of the sound beam crossing a boundary

(ii) conversion of sound to heat

(iii) redirection of a portion of the sound from the boundary beam

(iv) redirection of the sound in several directions [1]

(d) (i) Define the term attenuation coefficient [2]

(ii) Which of the following media has the lowest attenuation coefficient fat, air, muscle, bone [1]

(e) Frame rate in real-time scanning refers to:
(i) the image formed in one scan sweep

(ii) the number of images produced per second

(iii) the rate of reading information from a frame by an electron beam

(iv) the rate at which information is written in a frame [1]

(f) The width of an ultrasound beam measured perpendicular to the image plane determines the:

(i) axial resolution
(ii) depth resolution
(iii) lateral resolution
(iv) slice thickness [1]

(g) The speed with which a sound pulse travels through tissue depends on the:
(i) ultrasound frequency
(ii) duration of the pulse
(iii) tissue density and stiffness
(iv) pulse amplitude and tissue attenuation [1]

(h) What do you understand by the following terms:
(i) simple harmonic motion,
(ii) transverse wave,
(iii) characteristic impedance,
(iv) reflection coefficient, and
(v) matching impedance. [5 x 2]

(i) Complete the labels A to C in the diagram below. [3 x 1]