NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

SRA 3211 – **ULTRASOUND IMAGING**

*BSc HONOURS PART II**:*** *JULY 2013* *DURATION: 3 HOURS*
SUPPLEMENTARY EXAMINATION

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) Explain the significance of time gain compensation in ultrasound equipment. [3]

   (b) Use the Doppler Effect to explain how blood flow can be imaged. [5]

   (c) Explain any two ways that axial resolution can be improved [4]

   (d) Give three reasons why exposure to ultrasound should be minimized at all times. [3]

   (e) Describe the following artifacts commonly seen in ultrasound imaging:
   - (i) Reverberation [2]
   - (ii) Acoustic Shadowing [2]
   - (iii) Acoustic Enhancement [2]
   - (iv) Mirror image [2]
   - (v) Side lobes [2]

(f) Describe the main differences between ultrasound and x-ray imaging. [5]

(g)Compare and contrast the following electronic transducers: sector array and linear array transducers. [5]

(j) Evaluate the ways in which the operator may minimize exposure of patients to ultrasound. [5]

SECTION B

2. a) Discuss resolution in ultrasound imaging. [6]

b) An air pocket is accidentally trapped between the transducer array and the skin during ultrasound imaging. Describe the appearance of the image produced. [4]

c) Evaluate the design of a single element transducer module/assembly. [10]

3. (a) Giving at least three examples of pathologies, discuss ultrasound imaging of the female pelvis. [12]

(b) Giving appropriate examples, explain the factors influencing the choice of probes in ultrasound imaging. [8]

4. (a) Compare trans-vaginal and trans-abdominal scanning in the female pelvis. [10]

(b) Describe the ultrasonic appearances you would expect to see at 6 weeks gestational age and compare these appearances with those at 10 weeks gestational age. [10]

5. Ultrasound is considered to be a safe imaging modality. Discuss the biological effects of ultrasound and compare these with effects due to conventional x-ray imaging. [20]

6. Describe the following functional core modules of ultrasound equipment:

(a) Master control; [5]

(b) Pulse generator; [3]

(c) Transducer; [4]

(d) Signal manipulation and storage [5]

(e) Image display [3]

END OF EXAMINA TION