

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**APPLIED PHYSICS DEPARTMENT**

**SRA 3109 - SPECIALISED IMAGING TECHNIQUES**

*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.

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**SECTION A**

1. (a) With reference to macroradiography, explain why
  - (i) a small focal spot size is used. [2]
  - (ii) it is not necessary to use a secondary radiation grid. [3]
- (b) (i) Describe the principle of computed radiography (CR) [3]  
(ii) State TWO advantages of CR over conventional radiography [2]
- (c) Explain the significance of the tomographic angle to the image quality in conventional tomography. [5]
- (d) Explain why the radioisotope  $^{99m}\text{Tc}$  is widely used in Radio Nuclide Imaging (Nuclear Medicine) [5]
- (e) (i) With respect to interventional techniques, define the term embolisation. [2]  
(ii) State THREE reasons why embolisation maybe done. [3]
- (f) Explain why there is no movement unsharpness in an orthopantographic (OPG) image. [3]
- (g) State THREE ways by which depth can be visualized in radiographic images. [3]
- (h) Explain the care of patient given to a female undergoing radionuclide imaging using  $^{131}\text{I}$  [5]
- (i) Describe the care of patient to a patient undergoing magnetic resonance imaging. [4]

**SECTION B**

- 2 (a) Explain the basic principles of Magnetic Resonance Imaging (MRI) that enable soft tissue images to be obtained. [10]
- (b) Explain how slice selection is achieved in MRI [5]
- (c) Explain the significance of  $T_1$  and  $T_2$  weighting in MRI images [5]
- 3 (a) Explain the principle of operation of a 3<sup>rd</sup> generation Computed Tomography Scanner [8]
- (b) Explain what is meant by the term windowing, highlighting the its practical applications in CT scanning. [6]
- (c) Define the following terms:  
(i) Hounsfield number  
(ii) Partial volume effect  
(iii) Voxel [6]
4. With reference to Radionuclide Imaging
- (a) Explain how an image is obtained using a gamma camera. [10]
- (b) Explain why radionuclide bone imaging has a distinct advantage over radiographic imaging in skeletal survey. [4]
- (c) Define the terms 'hot' and 'cold' spots outlining their clinical significance in connection with bone scans. [3]
- (d) Differentiate a perfusion from a ventilation scan of the lungs. [3]
5. (a) Differentiate between digital subtraction and photographic subtraction. [3]
- (b) Describe the photographic subtraction procedure. [8]
- (c) Using a block diagram outline the digital subtraction process. [6]
- (d) State advantages of digital subtraction over photographic subtraction. [3]
6. Evaluate the role of CT, MRI, RNI and US in the imaging of brain pathology. [20]

- END OF EXAMINATION -