NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

SRA 3109 – SPECIALISED IMAGING TECHNIQUES

BSC HONOURS PART III: MAY 2006   DURATION: 3 HOURS

ANSWER ALL QUESTIONS FROM SECTION A AND ANY THREE QUESTIONS FROM SECTION B. SECTION A CARRIES 40 MARKS WHILE SECTION B CARRIES 60 MARKS.

SECTION A

1. (a) Explain the derivation of the mathematical formula for magnification calculation.   [5]

    (b) Compare and contrast the sensitometric and physical properties of duplication film and subtraction mask films.   [5]

    (c) Explain the significance of exposure angle in conventional tomography.   [5]

    (d) (i) Give 2 ways in which a xero radiographic image differs from conventional radiographic images.   [2]

         (ii) Evaluate the contrast of xero–radiographic image.   [3]

    (e) Outline the principles of computed radiography.   [5]

    (f) Explain the principles of image digitalisation.   [5]

    (g) Describe a radiographic method by which a 3 dimensional image can be obtained.   [5]

SECTION B

2. Using the following headings discuss the issue of patient safety in relation to magnetic resonance imaging:
   (i) static magnetic fields, [6]
   (ii) gradient magnetic fields. [6]
   (iii) radiofrequency and heating. [8]

3. With reference to Radionuclide Imaging (Nuclear Medicine)
   (a) describe the mechanisms of α, β and γ decay. [12]

   (b) The physical half life of $^{99}Tc^{m}$ is 6 hours. A $^{99}Tc^{m}$ labelled radiopharmaceutical has a biological half life in blood of 1.5hours.
   (i) Justify the use $^{99}Tc^{m}$ in radionuclide imaging. [5]

   (ii) Calculate the circulating activity in blood at 3 p. m following the injection of 256 MBq of the $^{99}Tc^{m}$ labelled radiopharmaceutical at 9.00 am. [3]

4. With reference to the principles of Computed Tomography and Radionuclide Imaging, compare and contrast the use of the two modalities in demonstration of renal pathology. [20]

5. (a) Explain the principle of operation of orthopantomography and discuss why there is no movement unsharpness and distortion in the final image. [10]

   (b) Discuss how the amount of scatter affects the tomographic image quality and how it may be controlled to maximise image quality. [10]

6. (a) Explain the principles of macro radiography [5]

   (b) Discuss the factors limiting image quality in macro-radiography. [15]

-END OF EXAMINATION-