POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2017

DEU6223 : MEDICAL IMAGING

TARIKH : **26 OKTOBER 2017**
MASA : **8.30 PAGI – 10.30 PAGI (2 JAM)**

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (2 soalan)

Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 60 MARKS
BAHAGIAN A: 60 MARKAH

INSTRUCTION:

This section consists of **4 (FOUR)** structured questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab SEMUA soalan.

QUESTION 1
SOALAN 1

CLO1
C1

(a) Define Bremsstrahlung (breaking radiation) in producing X-ray.

Definisikan bremsstrahlung (breaking radiation) dalam penghasilan X-ray.

[3 marks]

[3 markah]

CLO1
C2

(b) In diagnostic radiography, x-rays can be used to investigate the patient's illness or physical state. Explain briefly the operational principle of an X-ray tube.

Dalam rawatan radiografi, x-rays digunakan untuk memeriksa penyakit pesakit atau keadaan fizikal. Terangkan secara ringkas prinsip operasi tiub x-ray.

[5 marks]

[5 markah]

CLO1
C3

(c) Draw the block diagram of an X-ray equipment which consists of X-ray tube, collimator, Bucky Grid and X-ray detector.

Lukiskan gambarajah blok bagi mesin X-ray yang mengandungi tube X-ray, collimator, Bucky Grid and X-ray detector.

[7 marks]

[7 markah]

QUESTION 2
SOALAN 2

CLO2
C2

a) Identify **ONE (1)** advantage and **ONE (1)** disadvantage of Computed Tomography Scanner compared to conventional X-ray machine?

Tentukan SATU (1) kebaikan dan SATU (1) keburukan Computer Tomography Scanner dibandingkan dengan mesin X-ray traditional.

[3 marks]

[3 markah]

CLO2
C3

(b) Illustrate block diagram of a CT scanner.

Lakarkan gambarajah blok bagi pengimbas CT.

[6 marks]

[6 markah]

CLO2
C3

(c) CT image is a formation of a multi-step process. Explain each process clearly.

Pembentukan imej CT terdiri daripada proses pelbagai langkah. Terangkan setiap proses dengan jelas.

[6 marks]

[6 markah]

QUESTION 3
SOALAN 3

CLO2
C2

(a) Differentiate between diagnostic nuclear medicine and therapeutic diagnostic medicine for radioisotope imaging.

Bezakan antara perubatan nuklear diagnosis dan perubatan nuklear therapeutic untuk pengimejan radioisotop.

[3 marks]

[3 markah]

CLO2
C3

(b) Relate how **THREE (3)** components of gamma camera produce the image of radioisotope imaging

Hubungkaitkan bagaimana TIGA(3) komponen di dalam kamara gamma menghasilkan imej bagi pengimejan radioisotop,

[6 marks]

[6 markah]

CLO2
C3

(c) List **SIX (6)** examples of clinical application for radioisotopes imaging.

Senaraikan ENAM(6) contoh aplikasi klinikal untuk pengimejan radioisotop.

[6 marks]

[6 markah]

QUESTION 4
SOALAN 4

CLO1
C1

(a) Define magnetic resonance imaging (MRI).

Takrifkan pengimejan resonans magnetik (MRI.

[3 marks]

[3 markah]

CLO1
C2

(b) Explain **THREE (3)** advantages of MRI compared to CT scanner in differentiate tissue.

*Terangkan **TIGA (3)** kelebihan MRI dibandingkan dengan pengimbas CT dalam pembezaan tisu.*

[6 marks]

[6 markah]

CLO1
C2

(c) Explain the differences between Tissue Magnetization and Tissues Resonance.

Terangkan perbezaan antara Tissue Magnetization dan Tissues Resonance

[6 marks]

[6 markah]

SECTION B: 40 MARKS
BAHAGIAN B: 40 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan esei. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1
C3

a) Illustrate the A mode and B mode for scanning mode.

Ilutrasi mode A dan mode B bagi mode imbasan.

[6 marks]

[6 markah]

b) There are many applications of non-ionizing radiation in our daily life. The common examples of non-ionizing radiation in medical imaging are Ultrasound and Magnetic Resonance Imaging (MRI) machines.

Terdapat banyak aplikasi sinaran tak mengion dalam kehidupan harian kita. Dua contoh sinaran tak mengion dalam pengimejan perubatan adalah mesin Ultrasound dan mesin Magnetic Resonance Imaging (MRI).
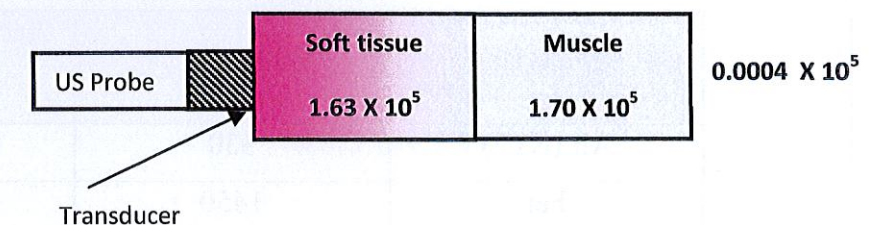

| US Probe | Soft tissue 1.63×10^5 | Muscle 1.70×10^5 | 0.0004×10^5 |

Transducer

Figure 1(b)

By referring to **Figure 1(b).** Calculate the total percentage of ultrasound reflection coefficient α_R at the transducer that received from different medium. (Ignore the ultrasound absorption due to its movement from various matters or medium).

*Berpandukan **Rajah 1(b)**, kirakan jumlah peratusan pekali pantulan ultrasound α_R pada transduser yang diterima daripada medium yang berbeza. (Abaikan penyerapan Ultrasound disebabkan oleh pergerakannya merentasi pelbagai bahan atau medium).*

Given:

The Percentage of Reflection Coefficient

$$(Peratus\ Pekali\ Pantulan),\ \alpha_R = \left(\frac{Z_2 - Z_1}{Z_2 + Z_1}\right)^2 \times 100\%$$

The fraction of the incident energy that is transmitted across an interface is described by the transmission coefficient α_T

Pecahan bagi tenaga yang berlaku dihantar melalui antaramuka dinyatakan oleh pekali penghantaran α_T

$$where\ \alpha_T = \frac{4Z_1 Z_2}{(Z_1 + Z_2)^2} \times 100\%$$

Z_1 and Z_2 are the acoustic impedances of the two media.

Z1 dan Z2 adalah galangan akustik bagi dua media.

Table : Speed of ultrasound and acoustic impedance in some common materials. Data from Wells (1969); Goss, Johnston, Dunn (1978); and Bamber (1986). The acoustic impedance cannot calculate when the density of the material is unknown

Material	Speeds (m/s)	Acoustic impedance $g/cm^2 s$
Air (NTP)	330	0.0004×10^5
Fat	1450	1.38×10^5
Kidney	1560	1.62×10^5
Muscle	1580	1.70×10^5
Soft tissue (average)	1540	1.63×10^5

[14 marks]
[14 markah]

QUESTION 2

SOALAN 2

CLO2
C4

a) A radioisotope of iodine, ^{131}I, has a half-life of 4 hours. The activity was measured as 160 MBq at 08:00 on 3rd February. Calculate its activity at 08:00 on 4th February.

Radioisotope iodine, ^{131}I mempunyai separuh hayat selama 4 jam. Aktivitinya diukur sebanyak 160 MBq pada pukul 8:00, 3 Februari 2014.Kirakan aktivitinya pada pukul 8:00 4 Februari 2014.

[8 marks]

[8 markah]

b) Explain the principle of controlling the radiation exposure by using shielding, time, material density and distance.

Terangkan prinsip mengawal pendedahan radiasi dengan menggunakan perisai ,masa, densiti bahan dan jarak.

[12 marks]

[12 markah]

SOALAN TAMAT