

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI  
KEMENTERIAN PENDIDIKAN MALAYSIA**

**JABATAN KEJURUTERAAN ELEKTRIK**

**PENILAIAN ALTERNATIF**

**SESI 1 : 2021/2022**

**DEU50043 : MEDICAL IMAGING**

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**NAMA PENYELARAS KURSUS: ROSHIDI BIN ZAKARIA**

**KAEDAH PENILAIAN : PEPERIKSAAN ATAS TALIAN**

**JENIS PENILAIAN : OPEN BOOKED ASSESSMENT  
SOALAN BERSTRUKTUR (2 SOALAN)  
ESEI (2 SOALAN)**

**TARIKH PENILAIAN : 25 JANUARI 2022**

**TEMPOH PENILAIAN : 2 JAM**

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**LARANGAN TERHADAP PLAGIARISM (AKTA 174)**

**PELAJAR TIDAK BOLEH MEMPLAGIAT APA-APA IDEA, PENULISAN, DATA  
ATAU CIPTAAN ORANG LAIN. PLAGIAT ADALAH SALAH SATU  
PENYELEWENGAN AKADEMIK. SEKIRANYA PELAJAR DIBUKTIKAN  
MELAKUKAN PLAGIARISM, PENILAIAN BAGI KURSUS BERKENAAN AKAN  
DIMANSUHKAN DAN DIBERI GRED F DENGAN NILAI MATA 0.**

**(RUJUK BUKU ARAHAN-ARAHAN PEPERIKSAAN DAN KAEDAH PENILAIAN (Diploma) EDISI 6, JUN 2019,  
KLAUSA 17.3)**

**SECTION A: 60 MARKS**  
**BAHAGIAN A: 60 MARKAH**

**INSTRUCTION:**

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

**ARAHAN:**

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

**QUESTION 1**

**SOALAN 1**

This question refers to the following diagram of Ultrasound imaging.  
*Soalan ini merujuk kepada rajah 1 Pengimejan ultrabunyi berikut.*

The following diagram 1 shows the ultrasound propagation through different medium and the oscilloscope displays the pulse amplitude against time for an ultrasound A-scan mode. Consider the path of the ultrasound wave used to image an internal organ. The received signal from the transducer is shown below as the ultrasound propagation pathway. There are reflected signals received at the transducer at 0.2 and 0.3 ms (millisecond) as shown in the signal plot. The ultrasound wave passes through a muscle, soft tissue and air.

*Gambar rajah 1 berikut menunjukkan perambatan ultrabunyi menerusi media yang berbeza dan osiloskop memaparkan denyutan amplitud melawan masa untuk imbasan mod A ultrabunyi. Pertimbangkan jalur gelombang ultrasound yang digunakan untuk mengimbas organ dalaman. Isyarat yang diterima dari pemindaharuh ditunjukkan di bawah ini sebagai jalur penyebaran ultrasound. Terdapat isyarat yang diterima pada pemindaharuh pada 0.2 dan 0.3 ms (milli saat) seperti ditunjukkan dalam plot isyarat. Gelombang ultrasound bergerak/tersebar melalui otot, tisu lembut dan udara.*

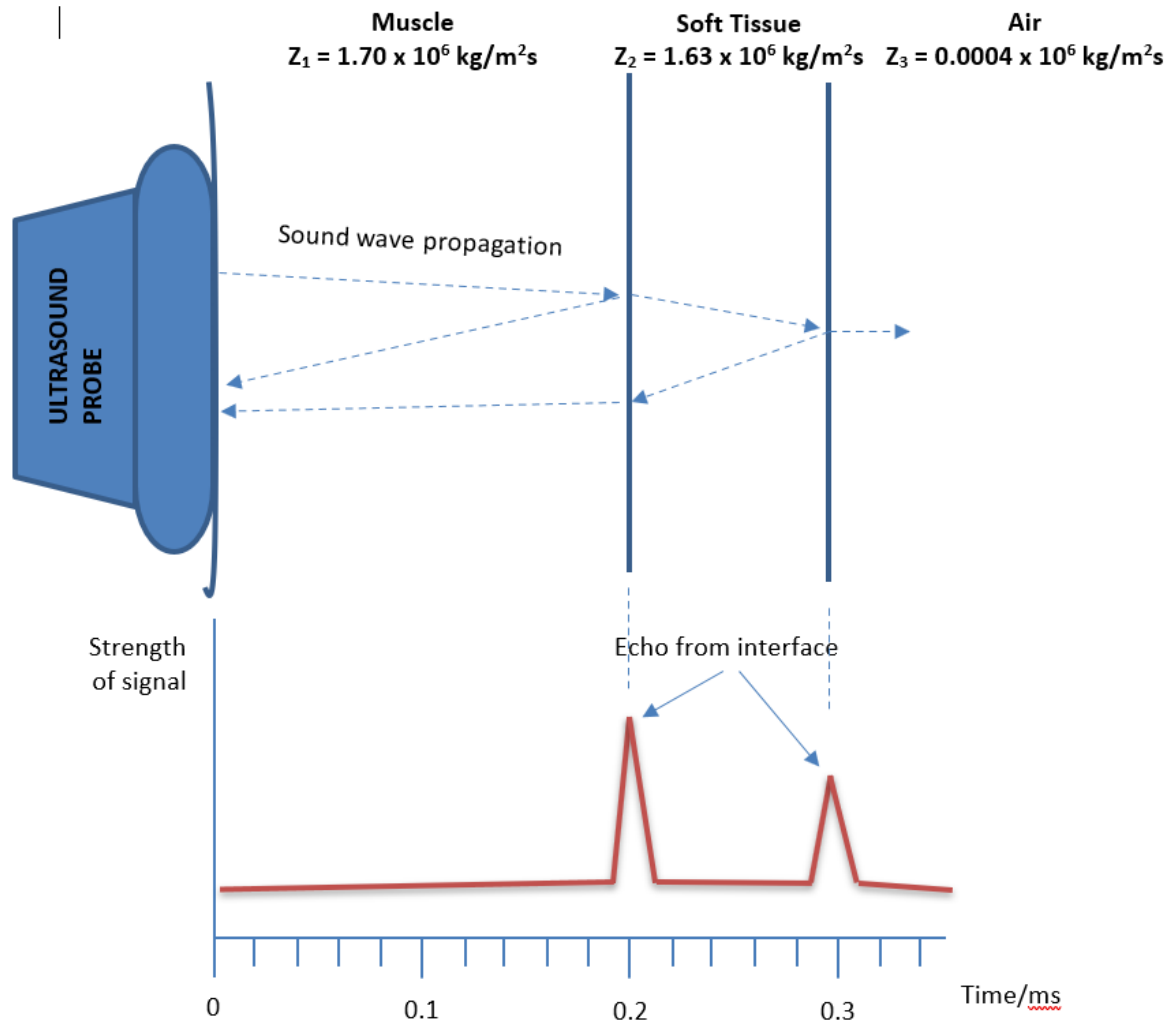


Figure 1: Ultrasound wave used to image an internal organ in human abdomen

CLO1  
C4

- (a) Determine the distance in centimetres (cm) from the transducer/body surface to the first interface of the muscle/soft tissue, to the second interface of the soft tissue /air, and the thickness of the soft tissue based on the time of the signal received and the material properties. Given, speed of sound in muscle ( $c = 1,580 \text{ m/s}$ ) and speed of sound in soft tissue ( $c = 1,540 \text{ m/s}$ ).

*Tentukan jarak dalam sentimeter (cm) dari permukaan badan ke antarmuka pertama otot/tisu lembut, ke antarmuka yang kedua tisu lembut/udara dan ketebalan tisu lembut berdasarkan masa isyarat yang diterima dan sifat bahan. Diberi halaju bunyi di dalam tisu lembut,  $c$  adalah  $1540 \text{ m/s}$  dan halaju bunyi di dalam otot,  $c$  adalah  $1580 \text{ m/s}$ .*

[10 marks]  
[10 markah]

CLO1  
C4

- (b) Determine the percentage of relative intensity by using the reflection coefficient equation of the ultrasound peaks received at 0.2, 0.3 ms (millisecond) and the last medium is air. Remember that the wave has to travel forward and backward from each interface.

*Tentukan peratus intensiti relatif dengan menggunakan persamaan koefisien pantulan bagi puncak ultrabunyi yang diterima pada 0.2, 0.3 ms (milli saat) dan medium terakhir adalah udara. Perlu diingatkan bahawa gelombang harus bergerak ke depan dan belakang dari setiap antaramuka.*

[10 marks]

[10 markah]

CLO1  
C4

- (c) Illustrate the propagation of a sound waves through the various mediums using the calculated value.

*Gambarkan penyebaran gelombang bunyi melalui pelbagai medium menggunakan nilai yang dikira.*

[10 marks]

[10 markah]

Given:

The Percentage of Reflection Coefficient

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

The fraction of the incident energy that is *transmitted* across an interface is described by the transmission coefficient  $\alpha_T$

$$\text{where } \alpha_T = \frac{4Z_1Z_2}{(Z_1+Z_2)^2} \times 100\%, \alpha_R + \alpha_T = 100\%$$

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

Distance = Speed x Time

$$\text{Distance of ultrasound propagation, } d = \frac{1}{2} \times \text{speed, } c \times \text{time duration, } \Delta t$$

Acoustic impedance (kg/m<sup>2</sup>s) = c, speed(m/s) × ρ, density (kg/m<sup>3</sup>)Acoustic impedance of Air (kg/m<sup>2</sup>s) = 0.0004 × 10<sup>6</sup> kg/m<sup>2</sup>s.

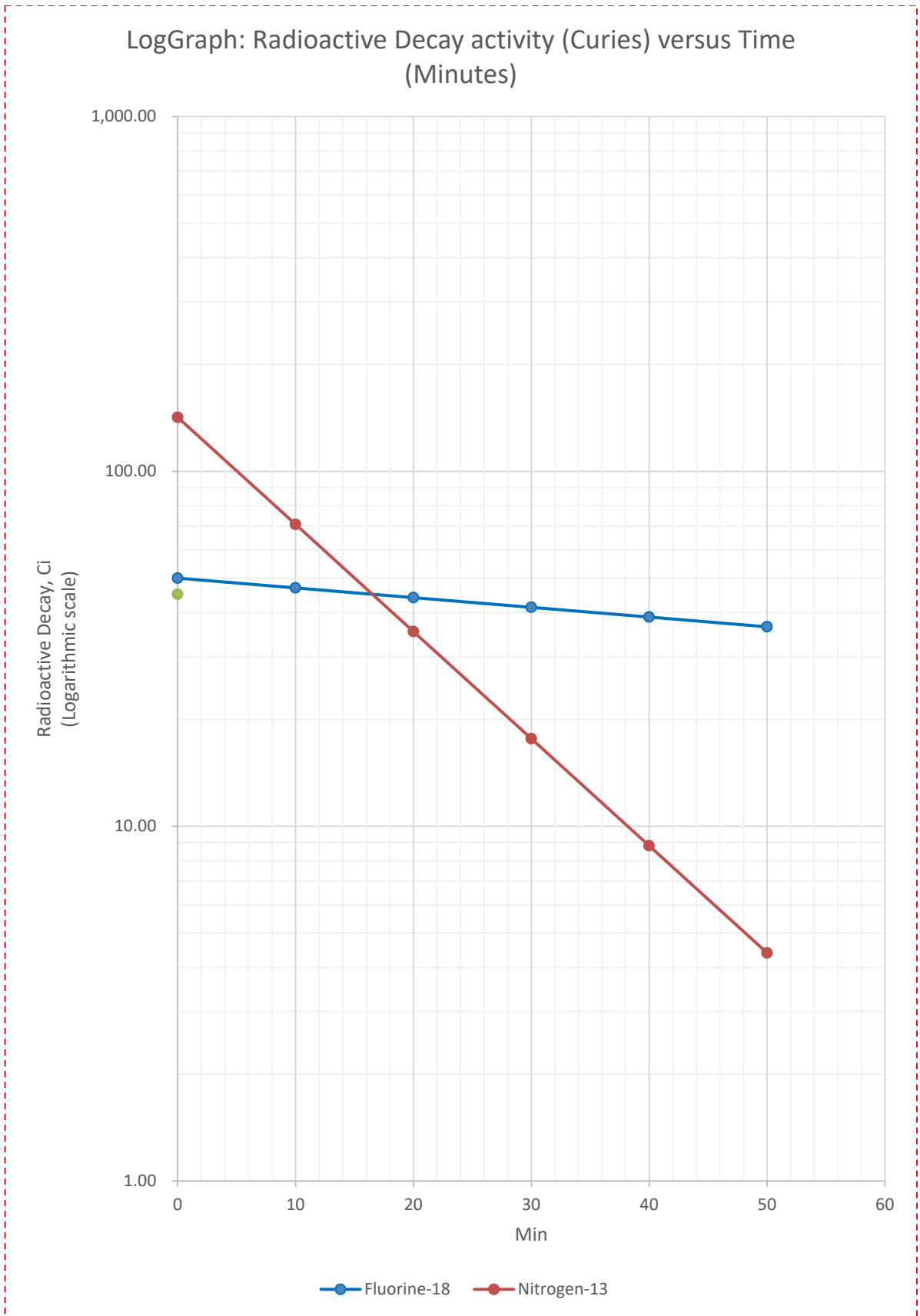
**QUESTION 2****SOALAN 2**

Flourine-18,  $^{18}\text{F}$  and Nitrogen-13,  $^{13}\text{N}$  are used in the nuclear imaging study. The initial activity of Flourine-18,  $^{18}\text{F}$  is 50 Curies and its half-life,  $t_{1/2}$  is 109.8 minutes. Whereas, the initial activity of Nitrogen-13,  $^{13}\text{N}$  is 142 Curies and the half-life,  $t_{1/2}$  is 9.97 minutes. Table 1 below shows an incomplete reading of an isotope material activity of Flourine-18,  $^{18}\text{F}$  and Nitrogen-13,  $^{13}\text{N}$  which are recorded every 10 minutes in time interval for 50 minutes duration. The following questions are referring to table 1 and graph 1.

*Flourine-18,  $^{18}\text{F}$  dan Nitrogen-13,  $^{13}\text{N}$  digunakan dalam kajian pengimejan nuklear. Aktiviti awal Flourine-18,  $^{18}\text{F}$  ialah 50 Curies dan separuh hayatnya ialah 109.8 minit. Manakala, aktiviti awal Nitrogen-13,  $^{13}\text{N}$  ialah 142 Curies dan separuh hayat ialah 9.97 minit. Jadual 1 di bawah menunjukkan bacaan tidak lengkap aktiviti bahan isotop Flourine-18,  $^{18}\text{F}$  dan Nitrogen-13,  $^{13}\text{N}$  yang direkodkan setiap 10 minit dalam selang masa selama 50 minit. Soalan berikut merujuk kepada jadual 1 dan graf 1.*

<b>Time (Minutes)</b>	<b>Fluorine-18, <math>^{18}\text{F}</math> (Ci)</b>	<b>Nitrogen-13, <math>^{13}\text{N}</math> (Ci)</b>
0	50.00	142.00
10		
20		
30		
40		
50		

Table 1: Radioactive decay of Fluorine-18,  $^{18}\text{F}$  and Nitrogen-13,  $^{13}\text{N}$



Graph 1: Radioactive Decay Activity (Ci) versus Time (Minutes)

CLO1  
C3

- (a) Calculate the activity of Fluorine-18,  $^{18}\text{F}$ , and Nitrogen-13,  $^{13}\text{N}$  for every 10 minutes in time interval for 50 minutes duration. Fill the calculated value of the activity for both radioactive in Table 1 below.

*Kira aktiviti Fluorine-18,  $^{18}\text{F}$ , dan Nitrogen-13,  $^{13}\text{N}$  untuk setiap 10 minit dalam selang masa selama 50 minit. Isikan nilai pengiraan aktiviti bagi kedua-dua radioaktif dalam Jadual 1 di bawah.*

Time (Minutes)	Fluorine-18, $^{18}\text{F}$ (Ci)	Nitrogen-13, $^{13}\text{N}$ (Ci)
0	50.00	142.00
10		
20		
30		
40		
50		

[10 marks]  
[10 markah]

CLO1  
C5

- (b) Calculate how much time  $t$  must elapse before these isotopes possess equal activities. Sketch the line on graph 1 or on your answer sheet to show your calculated answer. **ATTACH THIS GRAPH AS YOUR ANSWER SHEET.**

*Kira berapa lama masa yang mesti dilalui sebelum isotop ini mempunyai aktiviti yang sama. Lakar garis pada graf 1 atau kertas jawapan anda untuk menunjukkan jawapan kiraan anda. **LAMPIRKAN GRAF INI SEBAGAI KERTAS JAWAPAN ANDA.***

[10 marks]  
[10 markah]

CLO1  
C3

- (c) Some swabs have been contaminated with Nitrogen-13,  $^{13}\text{N}$  at 09:00 on 23 Nov. The level of activity from the swabs was measured at 70.86 Ci. If the activity of the swabs must be 0.14 Ci or less before they can be disposed of, calculate the earliest time the swabs can be sent for disposal?

*Beberapa kain pengelap telah dicemari dengan Nitrogen-13,  $^{13}\text{N}$  pada 09:00 pada 23 Nov. Tahap aktiviti dari kain pengelap diukur pada 70.86 Ci. Sekiranya aktiviti kain pengelap mestilah 0.14 Ci atau kurang sebelum ia dapat dilupuskan, kira masa paling awal pengelap boleh dihantar untuk dilupuskan?*

[10 marks]  
[10 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.*

CLO1  
C3

**QUESTION 1**  
**SOALAN 1**

Write an essay that clearly discusses how a radiographer can control the temperature of an x-ray tube and the quality of the x-ray beam during scanning. You must use the diagrams, graphs and calculation examples to assist your explanation.

*Tulis satu karangan yang membincangkan dengan jelas bagaimana radiographer boleh mengawal suhu tiub sinar-x dan kualiti alur sinar-x semasa pengimbasan. Anda mesti menggunakan gambar rajah, graf dan contoh pengiraan untuk membantu penjelasan anda.*

[20 marks]

[20 markah]

CLO1  
C3

**QUESTION 2**  
**SOALAN 2**

Write an essay that clearly discusses why Magnetic Resonance Imaging provides better tissue image differentiation and other advantages over other imaging modalities.

*Tulis satu karangan yang membincangkan dengan jelas mengapa Pengimejan Resonan Magnet memberikan pembezaan imej tisu yang lebih baik dan kebaikan lain berbanding kaedah pengimejan yang lain.*

[20 marks]

[20 markah]

**SOALAN TAMAT**