

SULIT



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

JABATAN KEJURUTERAAN ELEKTRIK

**PENILAIAN ALTERNATIF BERIKUTAN
PELAKSANAAN PERINTAH KAWALAN BERSYARAT**

SESI JUN 2020

KOD KURSUS : DEU50043 MEDICAL IMAGING

NAMA PENYELARAS KURSUS: ROSHIDI BIN ZAKARIA

KAEDAH PENILAIAN : PEPERIKSAAN ONLINE

JENIS PENILAIAN : SOALAN ESEI (2 SOALAN)

TARIKH PENILAIAN : 1 FEBRUARI 2021

TEMPOH PENILAIAN : 1 JAM

**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: 50 MARKS
BAHAGIAN A: 50 MARKAH**INSTRUCTION:**

This section consists of **TWO (2)** essay questions. Answer **ALL** questions and write your answer in the sheet form provided.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan esei. Jawab SEMUA soalan dan tulis jawapan anda di dalam helaian kertas yang disediakan.

CLO1
C4**QUESTION 1**
SOALAN 1

This question refers to the following diagram of Ultrasound imaging.
Soalan ini merujuk kepada rajah B1 Pengimejan ultrabunyi berikut.

The following diagram B1 shows the oscilloscope display of pulse amplitude against time for an ultrasound A-scan mode through a person's abdomen. Consider the path of the ultrasound wave used to image an internal organ. Assume that the weaker echoes come from internal organs. A signal received from the transducer is shown below as the ultrasound propagation pathway. There are reflected signals received at the transducer at 0.08, 0.12, 0.27 and 0.32 ms (millisecond) as shown in the signal plot. The ultrasound wave passes through a thin layer of gel ($\rho = 1,004 \text{ kg/m}^3$, $c = 1,555 \text{ m/s}$), water and soft tissue ($\rho = 1,058 \text{ kg/m}^3$, $c = 1,540 \text{ m/s}$), and the internal organ ($\rho = 1,038 \text{ kg/m}^3$, $c = 1,560 \text{ m/s}$).

Gambar rajah B1 berikut menunjukkan paparan osiloskop denyutan amplitud melawan masa untuk imbasan mod A ultrabunyi menerusi perut seseorang. Pertimbangkan jalur gelombang ultrasound yang digunakan untuk mengimbas organ dalaman. Anggaplah gema yang lebih lemah berasal dari organ dalaman. Isyarat yang diterima dari pemindaharuh ditunjukkan di bawah ini sebagai jalur penyebaran ultrasound. Terdapat isyarat yang diterima pada pemindaharuh pada 0.08, 0.12, 0.27 dan 0.32 ms (milli saat) seperti ditunjukkan dalam plot isyarat. Gelombang ultrasound bergerak/tersebar melalui lapisan nipis gel ($\rho = 1,004 \text{ kg/m}^3$, $c = 1,555 \text{ m/s}$), air dan tisu lembut ($\rho = 1,058 \text{ kg/m}^3$, $c = 1,540 \text{ m/s}$), dan organ dalaman ($\rho = 1,038 \text{ kg/m}^3$, $c = 1,560 \text{ m/s}$).

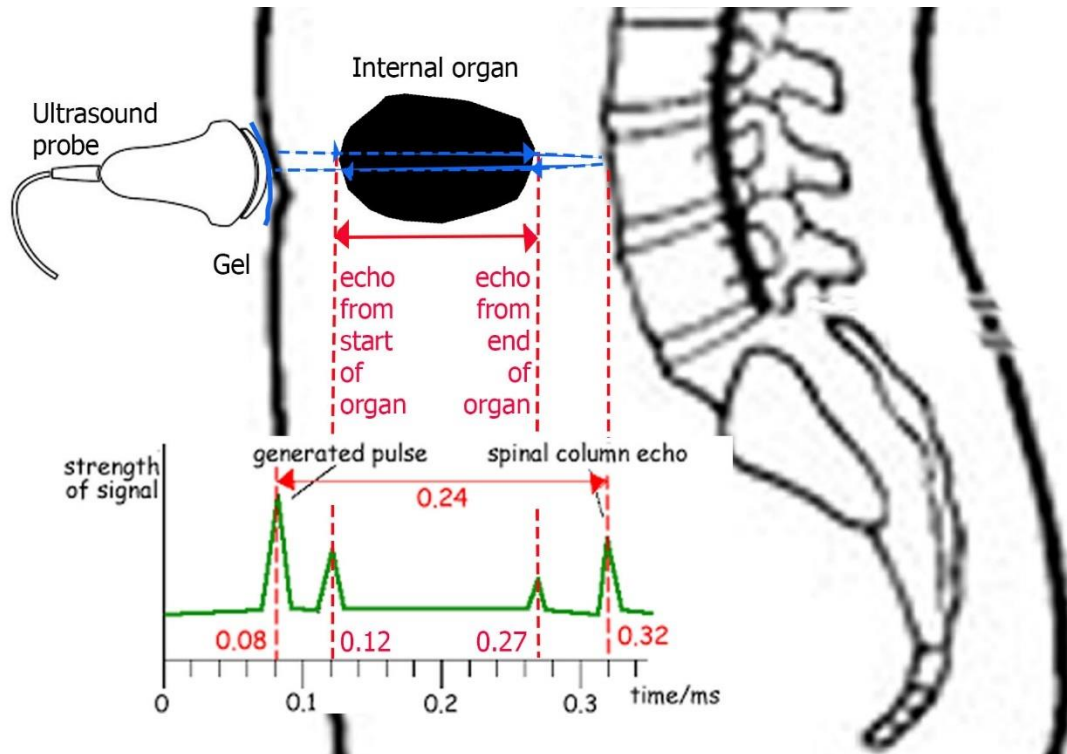


Figure B1: Ultrasound wave used to image an internal organ in human abdomen

(a) Explain the interpretation of how the spacing of the pulses.

Terangkan bagaimana jarak denyutan ditafsirkan.

[3 marks]

[3 markah]

(b) Determine the distance in centimetres (cm) from the transducer/body surface to the first interface of the internal organ (ignore gel thickness), to the second interface of the internal organ, and the thickness of the internal organ based on the time of the signal received and the material properties.

Tentukan jarak dalam sentimeter (cm) dari permukaan badan ke antaramuka organ dalaman pertama (abaikan ketebalan gel), ke antaramuka organ dalaman yang kedua, ke antaramuka ketiga ruang tulang belakang dan ketebalan organ dalaman berdasarkan masa isyarat yang diterima dan sifat material.

[8 marks]

[8 markah]

- (c) Determine the percentage of relative intensity by using the reflection coefficient equation of the ultrasound peaks received at 0.12, 0.27 ms (millisecond) and the last medium is air with Acoustic impedance = $0.0004 \times 10^6 \text{ kg/m}^2\text{s}$. Remember that the wave has to travel to and back from each interface.

Tentukan peratus intensiti relatif dengan menggunakan persamaan koefisien pantulan bagi puncak ultrabunyi yang diterima pada 0.12, 0.27 ms (milli saat) dan medium terakhir adalah udara dengan impedans Akustik = $0.0004 \times 10^6 \text{ kg/m}^2\text{s}$. Perlu diingatkan bahawa gelombang harus bergerak ke depan dan belakang dari setiap antaramuka.

[11 marks]

[11 markah]

- (d) 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.

[3 marks]

[3 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 α_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 ($\text{kg/m}^2\text{s}$) = c , speed(m/s) \times ρ , density (kg/m^3)

Acoustic impedance of Air ($\text{g/cm}^2\text{s}$) = 0.0004×10^5

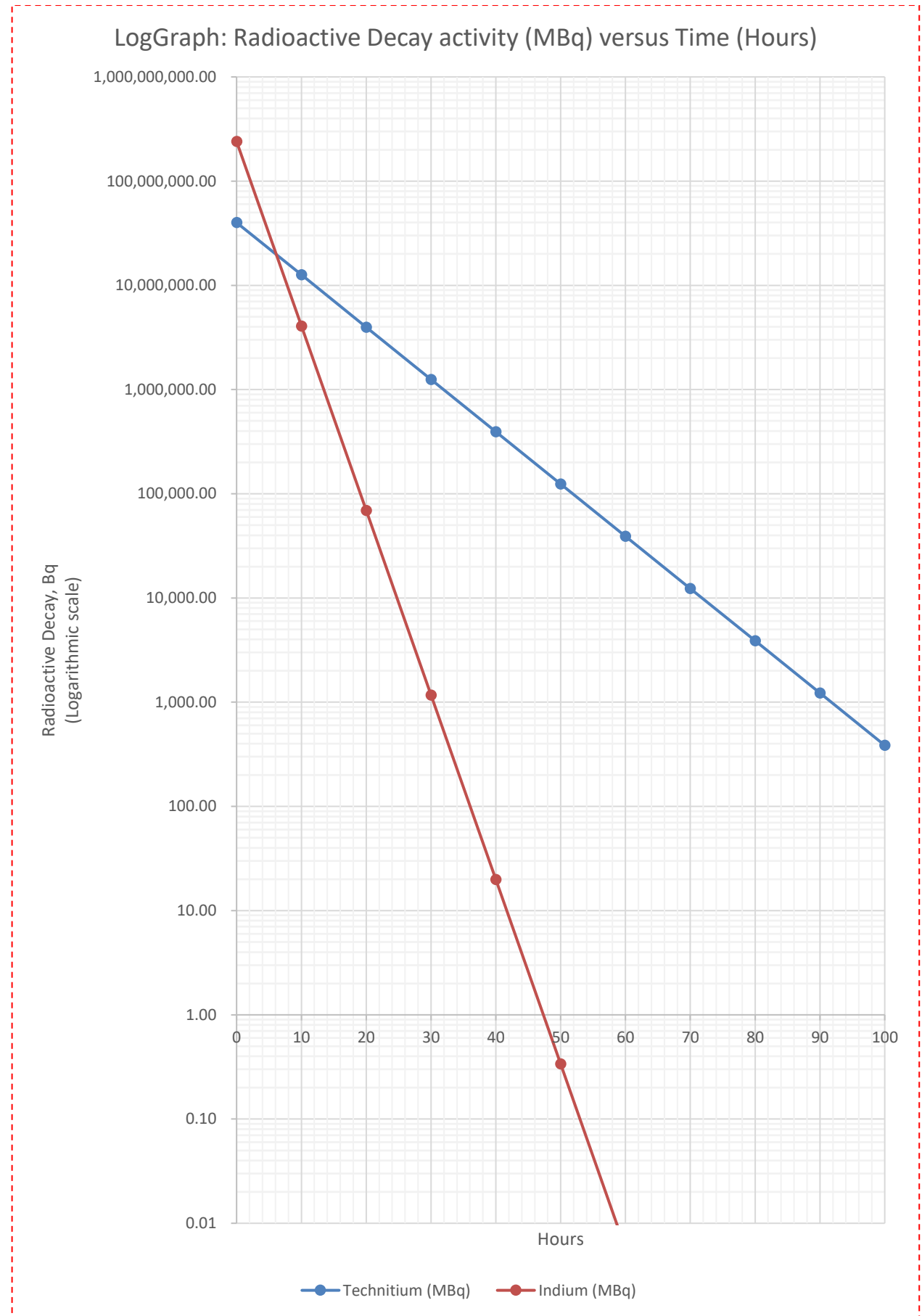
CLO1 | **QUESTION 2**
C4 | **SOALAN 2**

Table 1 and Graph 1 below show the reading of an isotope material activity of Technetium, ^{99m}Tc and Indium, ^{113}mIn which are recorded every 10 hours in time interval. The initial activity of Technetium, ^{99m}Tc at time equals to 0 is $1111.11115 \mu\text{Ci}$ (micro-Curie). The initial activity of Indium, ^{113}mIn at time equals to 0 is $6666.6667 \mu\text{Ci}$ (micro-Curie). $1 \text{ Curie} = 3.6 \times 10^{10} \text{ Becquerel}$. The following questions are referring to this graph.

Jadual 1 dan Graf 1 di bawah menunjukkan bacaan aktiviti bahan isotop Technetium, ^{99m}Tc dan Indium, ^{113}mIn yang direkodkan setiap 10 jam dalam selang waktu. Aktiviti awal Technetium, ^{99m}Tc pada masa bersamaan dengan 0 adalah $1111.11115 \mu\text{Ci}$ (micro-Curie). Aktiviti awal Indium, ^{113}mIn pada masa bersamaan dengan 0 adalah $6666.6667 \mu\text{Ci}$ (micro-Curie). $1 \text{ Curie} = 3.6 \times 10^{10} \text{ Becquerel}$. Soalan berikut merujuk kepada graf ini.

Time (Hours)	Technetium (Bq)	Indium (Bq)
0	40,000,000.00	240,000,000.00
10	12,602,301.48	4,072,138.68
20	3,970,450.06	69,092.97
30	1,250,920.22	1,172.32
40	394,111.84	19.89
50	124,167.91	0.34
60	39,120.03	0.01
70	12,325.06	0.00
80	3,883.10	0.00
90	1,223.40	0.00
100	385.44	0.00

Table 1: Radioactive decay of Technetium, ^{99m}Tc and Indium, ^{113}mIn



Graph 1: Radioactive Decay activity (MBq) versus Time (Hours)

- (a) What is the initial activity of these isotopes in Becquerel unit?

Apakah aktiviti awal bagi ke dua-dua isotop ini dalam unit Becquerel?

[2 marks]

[2 markah]

- (b)

- i. Using graph 1, estimate the half-life of the Indium, ^{113}mIn isotope. Sketch the line on graph 1 or on your answer sheet to show how did you do the estimation. **ATTACH THIS GRAPH AS YOUR ANSWER SHEET.**

*Berdasarkan kepada graf 1 di atas, anggarkan separuh hayat (half-life) bagi isotop Indium, ^{113}mIn ini. Lakar garis pada graf 1 atau kertas jawapan anda untuk menunjukkan bagaimana anda melakukan anggaran. **LAMPIRKAN GRAF INI SEBAGAI KERTAS JAWAPAN ANDA.***

- ii. Verify your answer with calculation.

Buktikan bacaan anda dengan pengiraan.

[9 marks]

[9 markah]

- (c) Calculate the decay constant for this Indium, ^{113}mIn isotope.

Kira Pemalar pereputan (decay constant) untuk isotop Indium, ^{113}mIn ini.

[2 marks]

[2 markah]

- (d) Using the calculated half-life of Indium, ^{113}mIn isotope and the half-life of Technetium, $^{99\text{mTc}}$ isotope is 6.0 hours, calculate how much time t must elapse before these isotopes possess equal activities.

Dengan menggunakan jangka hayat isotop Indium, ^{113}mIn dan separuh hayat isotop Technetium, $^{99\text{mTc}}$ adalah 6.0 jam, hitung berapa lama masa yang mesti dilalui sebelum isotop ini mempunyai aktiviti yang sama.

[12 marks]

[12 markah]

SOALAN TAMAT