SULIT

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

JABATAN KEJURUTERAAN ELEKTRIK

PENILAIAN ALTERNATIF

SESI DIS 2020

DEU50043 : MEDICAL IMAGING

NAMA PENYELARAS KURSUS: ROSHIDI BIN ZAKARIA

KAEDAH PENILAIAN : PEPERIKSAAN ONLINE

JENIS PENILAIAN : SOALAN ESEI (2 SOALAN)

TARIKH PENILAIAN : 8 JULAI 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.*

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 0.1and 0.3 ms (millisecond) as shown in the signal plot. The ultrasound wave passes through a soft tissue, muscle 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 0.1 dan 0.3 ms (milli saat) seperti ditunjukkan dalam plot isyarat. Gelombang ultrasound bergerak/tersebar melalui tisu lembut, otot dan udara.

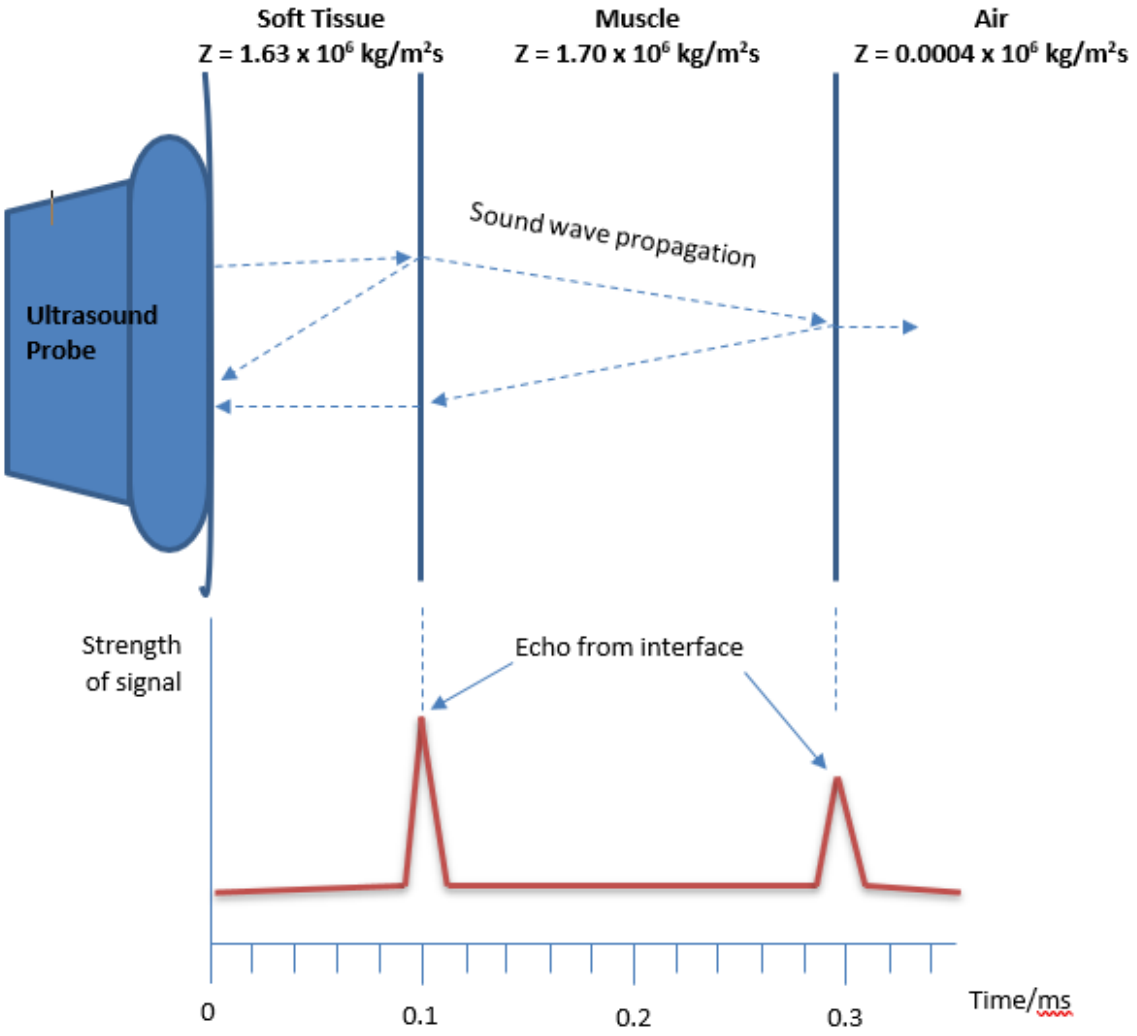


Figure 1: Ultrasound wave used to image an internal organ in human abdomen

CLO1
C4

(a) Determine the distance in centimetres (cm) from the transducer/body surface to the first interface of the soft tissue/muscle, to the second interface of the muscle/air, and the thickness of the muscle based on the time of the signal received and the material properties.

Tentukan jarak dalam sentimeter (cm) dari permukaan badan ke antaramuka pertama tisu lembut/otot, ke antaramuka yang kedua otot/udara dan ketebalan otot berdasarkan masa isyarat yang diterima dan sifat material.

[8 marks]
[*8 markah*]

CLO1
C4

(b) Determine the percentage of relative intensity by using the reflection coefficient equation of the ultrasound peaks received at 0.1, 0.3 ms (millisecond) and the last medium is air with Acoustic impedance = 0.0004×10^6 kg/m^{2}s. Remember that the wave has to travel forward and backward from each interface.

Tentukan peratus intensiti relatif dengan menggunakan persamaan koefisian pantulan bagi puncak ultrabunyi yang diterima pada 0.1, 0.3 ms (milli saat) dan medium terakhir adalah udara dengan impedans Akustik = 0.0004×10^6 kg/m^{2}s. *Perlu diingatkan bahawa gelombang harus bergerak ke depan dan belakang dari setiap antaramuka.*

[11 marks]
[*11 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.

[6 marks]
[*6 markah*]

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

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

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

Distance = Speed x Time

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

Acoustic impedance (kg/m^{2}s) = c, speed(m/s) × ρ, density (kg/m^3)

Acoustic impedance of Air (g/cm^{2}s) = 0.0004×10^6 kg/m^{2}s.

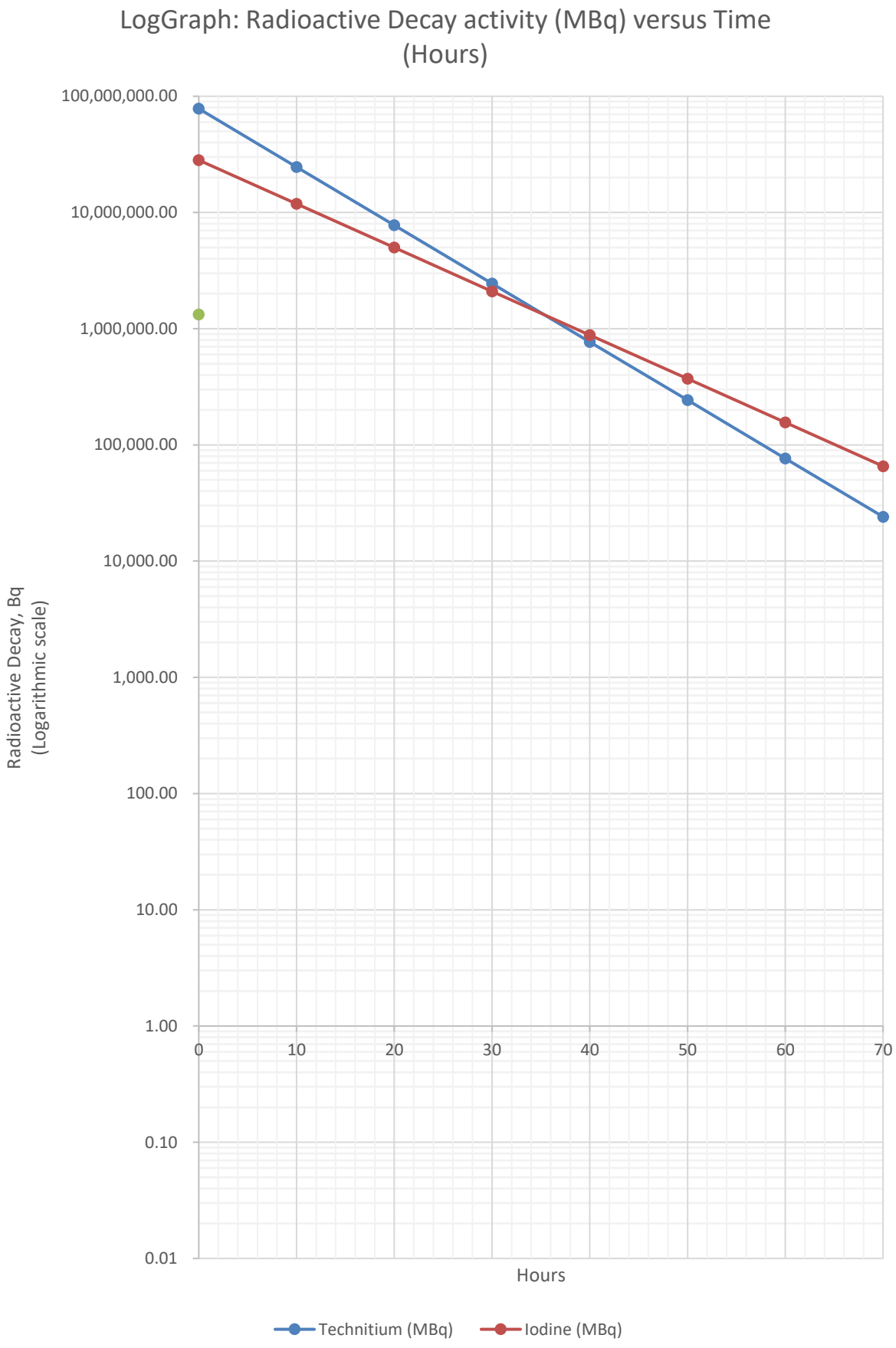
QUESTION 2
SOALAN 2

Table 1 and Graph 1 below show the reading of an isotope material activity of Technetium, 99mTc and Iodine, 131I which are recorded every 10 hours in time interval. The initial activity of Technetium, 99mTc at time equals to 0 is 78.2 MBq. The initial activity of Iodine, 131I at time equals to 0 is 28.2 MBq. 1 Curie = 3.6×10^{10} Becquerel. The following questions are referring to table 1 and graph 1.

Jadual 1 dan Graf 1 di bawah menunjukkan bacaan aktiviti bahan isotop Technetium, 99mTc dan Iodine, 131I yang direkodkan setiap 10 jam dalam selang waktu. Aktiviti awal Technetium, 99mTc pada masa bersamaan dengan 0 adalah 78.2 MBq. Aktiviti awal Iodine, 131I pada masa bersamaan dengan 0 adalah 28.2 MBq. 1 Curie = 3.6×10^{10} Becquerel. Soalan berikut merujuk kepada Jadual 1 dan graf 1.

Time (Hours)	Technetium (Bq)	Iodine (Bq)
0	78,200,000.00	28,200,000.00
10	24,637,499.39	11,858,820.99
20	7,762,229.87	4,986,937.42
30	2,445,549.02	2,097,134.69
40	770,488.65	881,898.75
50	242,748.26	370,860.97
60	76,479.67	155,956.52
70	24,095.50	65,583.70

Table 1: Radioactive decay of Technetium, 99mTc and Iodine, 131I



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

(a)

CLO1
C3

i. Using graph 1, estimate the half-life of the Iodine, 131I 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 Iodine, 131I ini. Lakar garis pada graf 1 atau kertas jawapan anda untuk menunjukkan bagaimana anda melakukan anggaran. ***LAMPIRKAN GRAF INI SEBAGAI KERTAS JAWAPAN ANDA.***

[4 marks]
[*4 markah*]

CLO1
C5

ii. Verify your answer with calculation.

Buktikan bacaan anda dengan pengiraan.

[7 marks]
[*7 markah*]

CLO1
C3

(b) Some swabs have been contaminated with Technetium, 99mTc at 08:00 on 1 Jun. The half-life of the isotope is 6 hours. The level of activity from the swabs was measured at 78.2 MBq. If the activity of the swabs must be 1 MBq 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 Technetium, 99mTc pada 08:00 pada 1 Jun. Separuh hayat isotop adalah 6 jam. Tahap aktiviti dari kain pengelap diukur pada 78.2 MBq. Sekiranya aktiviti kain pengelap mestilah 1 MBq atau kurang sebelum ia dapat dilupuskan, kira masa paling awal pengelap boleh dihantar untuk dilupuskan?

[7 marks]
[*7 markah*]

CLO1
C3

(c) Using the calculated half-life of Iodine, 131I isotope and the half-life of Technetium, 99mTc isotope is 6.0 hours, calculate how much time t must elapse before these isotopes possess equal activities.

Dengan menggunakan jangka hayat isotop Iodine, 131I dan separuh hayat isotop Technetium, 99mTc adalah 6.0 jam, hitung berapa lama masa yang mesti dilalui sebelum isotop ini mempunyai aktiviti yang sama.

[7 marks]
[*7 markah*]

SOALAN TAMAT