

SULIT

POLITEKNIK
Jabatan Pengajian Politeknik

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2013

EU601: MEDICAL IMAGING

TARIKH : 25 OKTOBER 2013
TEMPOH : 2 JAM (8.30 AM – 10.30 AM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.
Bahagian A: Struktur (10 soalan)
Bahagian B: Esei (3 soalan)
Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SULIT

EU601: MEDICAL IMAGING

SECTION A : 40 MARKS
BAHAGIAN B : 40 MARKAH

INSTRUCTION:

This section consists of **TEN (10)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **SEPULUH (10)** soalan berstruktur. Jawab semua soalan.*

QUESTION 1

CLO2
C2 Describe the use of ultrasound as a diagnostic tool in clinical medicine?

SOALAN 1

Jelaskan penggunaan ultrasound sebagai alat diagnostik dalam bidang perubatan klinikal?

[4 marks]

[4 markah]

QUESTION 2

CLO1
C1 State the advantages of piezoelectric ceramics?

SOALAN 2

Nyatakan kelebihan seramik piezoelektrik?

[4 marks]

[4 markah]

QUESTION 3

CLO3
C4 The half-life of Technetium - ^{99m}Tc Radioactive Isotope is 6.0 hours and 1.7 hours for Indium - ^{113m}In . How much time t must elapse before a 100-GBq sample of ^{113m}In and a 20-GBq sample of ^{99m}Tc possess equal activities?

SOALAN 3

Separuh hayat radioaktif Isotop technetium - ^{99m}Tc ialah 6.0 jam dan 1.7 jam untuk Indium- ^{113m}In . Berapa banyak masa t mesti berlalu sebelum 100 GBq sampel ^{113m}In dan 20 GBq sampel ^{99m}Tc mempunyai aktiviti-aktiviti yang sama?

[4 marks]

[4 markah]

QUESTION 4

CLO1
C1 List two types x-ray tube ?

SOALAN 4

Senaraikan dua jenis tiub x-ray?

[4 marks]

[4 markah]

QUESTION 5

CLO2
C2 Explain briefly the operational principle of computed tomography scanner (CT Scan) in producing radiographic images?

SOALAN 5

Jelaskan secara ringkas prinsip operasi pengimbas tomografi berkomputer (CT Scan) dalam menghasilkan imej radiografi?

[4 marks]

[4 markah]

QUESTION 6

CLO2
C1 State **THREE (3)** criteria which distinguish the evolution of each generation of CT Scan machine since the first generation?

SOALAN 6

*Nyatakan **TIGA (3)** kriteria yang membezakan evolusi setiap generasi mesin CT Scan sejak generasi pertama?*

[4 marks]

[4 markah]

QUESTION 7

CLO2
C2 Determine **FOUR (4)** criteria for selection of isotopes for nuclear imaging?

SOALAN 7

*Tentukan **EMPAT (4)** kriteria pemilihan isotop untuk pengimejan nuklear?*

[4 marks]

[4 markah]

QUESTION 8

CLO2
C2 Describe **FOUR (4)** components which affect the gamma camera sensitivity in radioisotope imaging?

SOALAN 8

*Jelaskan **EMPAT (4)** komponen yang memberi kesan kepada sensitiviti kamera gamma di dalam pengimejan radioisotop?*

[4 marks]

[4 markah]

QUESTION 9

CLO2
C2 Describe clearly the nuclear magnetic resonance phenomenon?

SOALAN 9

Terangkan dengan jelas fenomena salunan magnet nuklear?

[4 marks]

[4 markah]

QUESTION 10

CLO1
C1 State **TWO (2)** magnetic nuclei isotopes and **TWO (2)** non-magnetic nuclei isotopes?

SOALAN 10

*Nyatakan **DUA (2)** isotop nuklid magnet dan **DUA (2)** isotop nuklid bukan magnet?*

[4 marks]

[4 markah]

SECTION B : 60 MARKS
BAHAGIAN B : 60 MARKAH

INSTRUCTION:

This section consists of **THREE (3)** essay questions. Answer **ALL** questions.

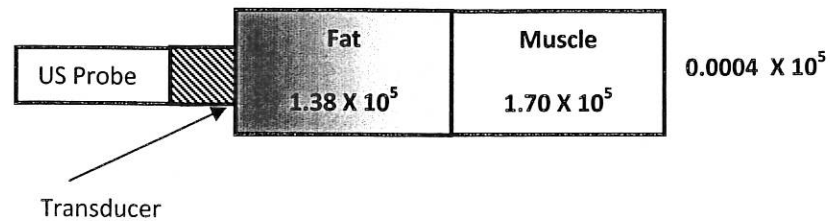
ARAHAN:

Bahagian ini mengandungi TIGA (3) soalan esei. Jawab SEMUA soalan.

QUESTION 1
SOALAN 1

CLO2
C3

- (a) This question refers to the following figure.
Soalan ini merujuk kepada rajah berikut.



Calculate the total percentage of ultrasound reflection coefficient α_R at transducer received from different medium? (Ignore ultrasound absorption due to its movement from various matters or medium).

Kira jumlah peratus pekali pantulan ultrabunyi α_R pada pemindaharuh yang diterima daripada medium yang berbeza? (Abaikan penyerapan ultrasound disebabkan oleh pergerakan daripada pelbagai perkara atau media).

Given:

Diberi:

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

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

Z_1 and Z_2 are the acoustic impedances of the two 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 be calculated where the density of the material is not known.

Material	Speeds (m/s)	Acoustic impedance $\text{g/cm}^2\text{s}$
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

[10 marks]

[10 markah]

CLO2
C4

- (b) Magnetic Resonance Imaging is an imaging modality which uses non ionising radiation. Explain clearly how this imaging modality is different with other imaging modalities?

Magnetic Resonance Imaging adalah modaliti pengimejan yang menggunakan sinaran mengion bukan. Terangkan dengan jelas bagaimana modaliti pengimejan ini adalah berbeza dengan kaedah pengimejan lain?

[6 marks]

[6 markah]

CLO2
C2

- (c) Describe clearly the nuclear alignment concept when magnetic nuclides under strong magnetic fields?

Terangkan dengan jelas konsep penjajaran nuklear apabila nuklid magnet berada di bawah medan magnet yang kuat?

[4 marks]

[4 markah]

QUESTION 2

CLO2
C3

SOALAN 2

- (a) In diagnostic radiography, X-rays can be used to investigate the patient's illness or physical state. Explain clearly the principal interactions involved in the production of a radiographic image?

Dalam radiografi diagnostik, sinar-X boleh digunakan untuk menyiasat penyakit pesakit atau keadaan fizikal. Terangkan dengan jelas prinsip interaksi yang terlibat dalam pengeluaran imej radiografi?

[10 marks]

[10 markah]

- (b) Discuss why a change in the filament heating current produces a change in the X-ray tube current (mA).

Bincangkan mengapa perubahan arus pada filamen pemanas akan menghasilkan perubahan pada arus tiub sinar X (mA)?

[5 marks]

[5 markah]

- (c) Explain briefly the function of detector used in CT scanner?

Terangkan secara ringkas fungsi pengesan yang digunakan dalam pengimbas CT?

[5 mark]

[5 markah]

QUESTION 3

CLO1
C1

- (a) List **THREE (3)** general principles of radiation protection?

Senaraikan TIGA (3) prinsip umum perlindungan sinaran?

[6 marks]

[6 markah]

CLO2
C1

- (b) State the radiation dose for radiation worker and public?

Nyatakan dos sinaran untuk pekerja sinaran dan orang awam?

[4 marks]

[4 markah]

CLO2
C3

- (c) Explain clearly Single-Photon Emission Computed Tomography imaging technique?

Terangkan dengan jelas teknik pengimejan "Single-Photon Emission Computed Tomography"?

[5 marks]

[5 markah]

CLO2
C4

- (d) Differentiate between imaging modalities of SPECT and X ray CT?

Bezakan antara kaedah pengimejan SPECT dan X ray CT?

[5 marks]

[5 markah]

SOALAN TAMAT