
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

ZME 336/4 – Medical Instrumentations
[Instrumentasi Perubatan]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains **FOUR** printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instruction: Answer **FOUR** question. If a candidate answers more than four questions, only the first four questions in the answer sheet will be graded.

Arahan: Jawab **EMPAT** soalan. Jika calon menjawab lebih daripada empat soalan hanya empat soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.

.../2-

1. (a) With the aid of a suitable diagram, describe how X-rays is produced in an X-ray tube.
[Bebantukan rajah yang sesuai, perihalkan bagaimanakah sinar-X dihasilkan dalam suatu tiub sinar-X.]
 [40/100]
- (b) Explain why a rotating anode tube is much superior in its design and functions compared to a stationary anode tube.
[Terangkan mengapa suatu tiub anod berputar adalah lebih baik dalam rekabentuk dan fungsi berbanding tiub anod pegun.]
 [30/100]
- (c) With the aid of a diagram, briefly explain the anode heel effect and how does the effect can be reduced. What is the relationship between this effect and the tube rating?
[Bebantukan lakaran rajah, terangkan secara ringkas kesan tumit anod dan bagaimanakah kesan itu dapat dikurangkan. Apakah hubungan di antara kesan ini dan kadaran tiub?]
 [30/100]
2. (a) Discuss to what extent do kVp, mA, timing, and filters affect the X-ray beam produced by an X-ray tube.
[Bincangkan setakat manakah. kVp, mA, pemsasaan, dan penuras mempengaruhi alur sinar-X yang dihasilkan oleh suatu tiub sinar-X?]
 [80/100]
- (b) Why do M,N,O,... characteristic radiations not emitted after bombardment of high energetic electrons on the tungsten target of an X-ray tube?
[Mengapakah sinar cirian M,N,O,... tidak dikeluarkan selepas hentaman elektron-elektron bertenaga tinggi ke atas sasaran tungsten suatu tiub sinar-X?]
 [20/100]

3. (a) With the aid of a diagram, describe the main components of a superconducting Magnetic Resonance Imaging (MRI) system.
[Berbantuan lakaran rajah yang sesuai, perihalkan komponen-komponen utama sistem Pengimejan Resonans Magnet (MRI) superkonduksian.]
[60/100]
- (b) What is the main purpose of an active shield in a superconducting magnet? Sketch a graph of radial distance against axial distance of a superconducting magnet to show the magnetic fringe field at 0.5 T, 1.0 T and 1.5 T:
- (i) with a conventional superconducting MRI magnets, and
[dengan suatu magnet MRI superkonduksian, dan]
- (ii) with an active shield.
[dengan suatu perisai aktif.]
[40/100]
4. (a) With the aid of a suitable diagram, explain the principal components of a single element ultrasound transducer.
[Berbantuan lakaran rajah yang sesuai, terangkan komponen-komponen utama suatu transduser ultrasaun unsur tunggal.]
[50/100]
- (b) Describe the ultrasound beam produced by a rectangular crystal of dimensions $a \times b$.
[Perihalkan alur ultrasaun yang dijanakan oleh suatu hablur empat segi bujur berdimensi $a \times b$.]
[50/100]
5. (a) State the 4 types of biomedical lasers.
[Nyatakan 4 jenis laser biomedical.]
[10/100]

...4/-

- (b) Describe the output characteristics (cavity medium, lasing species, method of excitation and efficiency) and output beam characteristics (output power and wavelength) of one of these biomedical laser mentioned in question 5(a).

[Perihalkan ciri-ciri output (mediumrongga, spesies pelaseran, kaedah pengujian dan kecekapan) dan ciri-ciri alur output (kuasa dan jarak gelombang output) salah satu laser biomedikal yang dinyatakan dalam soalan 5(a).]

[50/100]

- (c) Describe the clinical use of one of these biomedical lasers mentioned in question 5(a).

[Perihalkan kegunaan klinikal salah satu laser biomedikal yang dinyatakan dalam soalan 5(a).]

[40/100]